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## CYBERNETICS, COMPUTER AND AUTOMATION TECHNOLOGY

### COMPUTERS IN CEMA FORESTRY OPERATIONS

Moscow MEZHDUNARODNYY SEL'SKOKHOZYAYSTVENNYY ZHURNAL in Russian No 2, 1978 p 110

[Article by N. Gusev, Deputy Chief of the All-Union Association USSR "Lesproyekt": "Computers Serving Forestry in CEMA Member Countries"]

[Text] On 21-26 November 1977 a conference of forest management specialists of CEMA member countries was held in the Soviet Union (Leningrad) on problems of utilization of a unified computer system (YeS EVM) in forestry. Taking part in the conference were delegations from Bulgaria, Hungary, the GDR, Poland, the USSR, Czechoslovakia and representatives of the CEMA Secretariat.

The representative of Bulgaria shed light in his report on matters of modeling computer processes for determining planting stocks based on complete or partial recount data on trees. The models indicated may serve as a fine basis for full automation of the computation of reserves during processing of data on forest management and compiling of plans for timber cutting.

The report of the Hungarian delegation was devoted to the application of computers in that country's forest management. Currently, three computer systems are in use. The first supplies input, monitoring, processing and storage of information on soil and climatic and phytosociological indices. The second carries out calculation of wood reserves and other statistical indices based on data on full tree counts or on selective enumerative assessment. The third is used in processing information on actual timber enumeration and planning data in the process of inventorying forest tracts.

Along with the application of computers in the processing of forest management information and in forest management planning, computer systems have been developed in Hungary which furnish automated monitoring of economic activity in forestry, updating of the stock of timber including calculation of economic measures carried out in it, and some other things.

The GDR representative reported that a model unified system has now been developed in their country which aims at further improvement in the planning and management of forestry, including development of a forecast of forestry

development, long-term and annual planning, monitoring of work plan fulfillment, as well as an information base representing a data bank on timber stocks. The bank also stores data on the scope of forestry operations planned during 1976-1980 and their actual execution. Once in 10-15 years the updated data on the stock of timber and its dynamics is superceded by ordinary forestry data.

It was noted in the Polish specialists' report that a system is being created for forestry in Poland that includes several subsystems: forest management, accounting of economic operations carried out, updating of data on timber stocks, raw timber turnover and financial accounting. Whereas until now the processing of forest, management data on computers has been carried out using an independently created system, it is now going into the forestry information system as a whole in the form of one subsystem linked with others. Employing forest management information processed on computers, data banks utilizable for a running calculation of the status of timber stocks and wood resources will be established in regional forestry administrations.

In the USSR beginning in 1976 a complex developed by the All-Union Association "Lesproyekt" was introduced. It consists of 90 programs of the subsystem "Forest Management Information Processing" of OASU-leskhoz on YeS 1020 (1022) computers. Using computers, this complex furnishes the production of 45 tables characterizing timber stocks and records projected for the economic operations census period.

In recent years two Lesproyekt automated production control system tasks have been developed and are in process of introduction: long-range planning of the development and distribution of forest management operations and accounting, monitoring and analysis of labor and salaries; and also a timber stock accounting subsystem with updatable data bank on a unified computer system.

In the Czechoslovak delegation's report it was pointed out that during 1975-1976 the problem of forest management information processing and establishment of an economic book for a unified computer system was solved.

In Czechoslovakia a government-wide permanent inventory operation is also being carried out. For this purpose an annually updated data bank was established in 1972-1973 which contains indices describing timber stocks and volume of planned and executed operations.

Conference participants noted that in recent years CEMA member countries have attained considerable success in applying mathematical methods and computers in forestry and forest management.

The trends of greatest common interest for forest management organizations of CEMA member countries were delineated by the conference in the area of scientific and technical developments in the application of mathematical methods and computers in forest management and in sectorial subsystems of forestry automated control systems. It is advisable that this material be considered in compiling plans of scientific and technical collaboration.



The utilization of mathematical methods and computers in forestry and forest management makes it possible to efficiently obtain reliable information for planning and management in the sector and to improve the basis of the projected scope of operations and evaluations of their results. All of this will ensure an improved effectiveness and qualitative level of forestry output.

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## CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

### TADZHIK SSR COMPUTER TECHNOLOGY UTILIZATION IMPROVEMENT METHODS OUTLINED

Moscow VESTNIK STATISTIKI in Russian No 5, 1978 pp 62-67

[Article by I. Karimov and I. Soliyev: "Ways of Enhancing the Effectiveness of Utilization of Computer Technology in the Tadzhik SSR"]

[Text] Enhancement of the effectiveness of the operation of computer centers and of the utilization of computer equipment is a multifaceted process, in the course of which have originated more and more refined forms of economic control. Functioning at the present time in the republic's 39 rayons and cities are computing and information centers and Tadzhik SSR TsSU [Central Control System] centers whose services are being utilized by more than 860 customers, including 285 agricultural enterprises and 99 centralized accounting offices. In addition, also functioning in the republic's ministries and departments are computing and information centers which include in their structure modern computers such as the "Minsk-22," "Minsk-32," YeS-1020, YeS-1022, M-220, "Mir," "Nairi," Promin'," etc.

At the Tadzhik SSR TsSU RVTs [Republic Computing Center], on the "Minsk-22" computer are being processed periodic reports for industrial enterprises on product output and number of industrial production personnel and workers, and reports on fulfillment of the plan for labor in industry (form No 2-t), and on the "Minsk-32" computer reports on fulfillment of the plan for putting capacities into operation and of the capital investment plan (form 2-ks), and reports on the submission and implementation of inventions and suggestions by efficiency experts (form No 4-nt), etc.

The Leninabad Oblast Statistical Administration VTs [computing center], in addition to statistical work for the oblast's enterprises and organizations, is developing with the "Minsk-32" computer reporting documentation for the flow of realizable assets and of finished products and for the realization of the latter.

It should be mentioned that of all the computing centers in the republic the computer is being utilized effectively only at the Tadzhik SSR TsSU RVTs, the Tadzhik SSR AN [Academy of Sciences] VTs, the Tadzhik SSR Minvodkhov [Ministry of Water Resources] ASU-Tadzhvodkhov Planning Organization, Tadzhik State

University imeni V.I. Lenin, and the Leninabad Oblast Statistical Administration VTs. Here the mean 24-hour machine workload is from 11.2 to 16.8 hours. Least effective use is being made of computers at the USSR Ministry of Power and Electrification Tadzhik Scientific Research Division of Power Engineering and at the Nurek GES Construction Administration, where the mean 24-hour computer workload is a total of 0.5 to 0.8 hours. Therefore, special consideration must be given to questions relating to improving the effectiveness of the operation and utilization of computers in the republic's socialist economy, which are questions of great national economic importance.

Questions relating to improving the economic effectiveness of the operation of computing centers and of the utilization of computer equipment in the national economy are evaluated first of all from the viewpoint of the objective necessity of solving this problem within the framework of the overall development and improvement of planning and controlling the republic's socialist economy. Therefore, questions relating to functioning of the system of computing centers and to utilization of computers should be dealt with chiefly not only from the viewpoint of reducing the number of administrative and management personnel, but also as a fundamentally new vehicle conducive to further improvement of the quality of control, and, consequently, to improvement of the effectiveness of socialist production.

L.I. Brezhnev, at the 25th CPSU Congress, said: "The time has ripened for the problem of improving methods of reaching an overall solution to large-scale problems of an all-State interindustrial and territorial nature. Needed here are unified, centralized programs encompassing all stages of the job, from planning to practical implementation."\*

In talking, in this regard, of improving the effectiveness of the operation of computing centers and of utilization of computers in the republic's socialist economy, the conclusion must be drawn that the rate and level of development of computing centers depend wholly on the total prospects for and the infrastructure of the republic's economy and on its economic proportions territorially, and cannot be based on current volumes of information without interpretation of its objectivity, usefulness and appropriateness.

One of the most expedient ways of improving the effectiveness of the operation of the network of computing centers in the republic's control system is to increase the concentration and share of large computing centers in processing economic information.

As an economic criterion for the optimal size of a VTs sometimes employed are such indicators as minimum imputed production costs and the degree of total processing and the rate of transmission of information to customers. In our

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\*"Materialy XXV s"yezda KPSS" [Materials of the 25th CPSU Congress], Moscow, Politizdat, p 61.

opinion this type of estimate is not legitimate for many reasons. One is that here allowance is not made for the amount of derived information, which becomes known only after modeling and solving a specific problem. Basing a network of computing centers on current volumes of information cannot be acknowledged as proper, since it releases the VTs network "to the waves" without allowing for performance characteristics and final results, the importance and scale of solutions, and their possible variants. The essence of the solution to this problem lies in reflecting the indivisibility of all causes determining the effectiveness of operation of computing centers and the degree of utilization of computer technology in the socialist economy of the Tadzhik SSR.

Dependent on the optimal size of a computing center are specific capital expenditures, the cost level of the computing process, opportunities for appropriate allocation of work at the computer center, specialization of individual elements of the computing process, the level of overhead, the economic feasibility of creating laboratories, design bureaus and experimental units, and the concentration of skilled personnel.

A major indicator of the optimal size of a computing center is the ability to design an efficient computing process based on synchronous operation (output) of all types of equipment.

Studies have shown that the cost of processing information is lowered when a high degree of synchronism is achieved in operation of equipment.

Let us discuss some of the most expedient, in our opinion, ways of improving the effectiveness of the operation of VTs's and of the utilization of computer equipment. The first way is to set up wherever necessary a multiple user VTs. Necessary here is an intelligent combination for creating multiple user computing centers with special-purpose computing centers.

The second way to improve the effectiveness of utilization of computer technology is mutual aid and cooperation among VTs's in different departments. At the modern stage implementation of this economic method does not imply hierarchical subordination of one system to another. Therefore, in the first place full use should be made of the benefits of specialization and work sharing. Cooperation between the republic's computing centers in different departments should be based on a proper relationship between all-State and departmental interests.

The third way is to establish a unified longterm technical policy with regard to computers and other VTs hardware. This means that all VTs's should be furnished in the future with uniform computer equipment, should achieve interaction in the area of utilizing peripherals and unifying information entry, and pursue a unified policy in the employment of effective equipment for retrieving information, punching it out, reading it out, and circulating it.

The fourth way consists in a proper relationship between the social and working conditions of human activity and the operation of computers and other equipment.

Here it is necessary to provide for the proper organization of instrument panels, control consoles and work places, and for optimal operating modes determined with regard to the volume and rate of transmission of information.

The fifth way is to coordinate a personnel policy, i.e., to introduce a staff structure for computing centers of several types and to use unified wage scales for personnel at computing centers in different departments. Furthermore, raising the skills of production and management personnel will be accomplished in keeping with a unified program, standard training will be arranged for operators, and a scientifically substantiated list of requirements will be developed to determine the level of skills of computing center personnel.

The sixth way is to create model computing centers--standards, whose knowhow can be generalized and disseminated. The seventh is standardization of computing procedures to ensure a savings from the information processing production process. This implies the creation of standard computing procedures, flow-charts and programs of a modular nature, and the acceptance of unified methodological principles for the structure and functioning of a computing center network and of unified attitudes toward a computing center.

The development and distribution of the Tadzhik SSR computing center network for the long term reflects the influence of a number of general national-economic and economic factors based on specific relationships. These factors are economic indicators for determining the effectiveness of the development of the network of computing centers and computer equipment in the republic. The first group of economic factors is comprised of longterm factors whose essence cannot be determined only by today's requirements. The presence of natural resources and the level of economic development are the main actively effective factors which determine development rates and scales and the effectiveness of the computing center network.

The second group is comprised of factors relating to the overall national economic effect: the overall national economic effect, determined on the basis of an economic analysis of problems solved at computing centers; the level of the information service; and the level of development of science and the availability of personnel, determined on the basis of using methods of expert evaluation.

But an unambiguous determination of longterm estimates of information is impossible. Attempts to extrapolate trends do not give substantiated results. Therefore it is more advisable to use information estimates which are made to depend on general rules and trends in economic development. For precise allowance for the time factor it is possible to employ net models, which are realized by applying the familiar mathematical apparatus for analyzing and evaluating nets.

The third group of economic factors for determining the effectiveness of the operation of computing centers and of the utilization of computers is comprised of the amount of capital investment and the cost of computing operations. These factors are determined on the basis of using indicators for minimization of imputed costs for creating computing centers.

Experience gained in operating computing centers and using computer equipment in the socialist economy of the Tadzhik SSR has shown the presence in this area of serious shortcomings which have a negative influence on effectiveness. The following can be singled out: shortcomings in organization of operations and in planning the utilization of computer technology; the lack of a coordinating agency for employment and utilization of computer equipment at the republic level; untimely performance and the limited nature of overhaul operations and the lack of a service for offering technical assistance; an insufficient number of specialists in the employment and utilization of computer equipment; inadaptability of individual kinds of computer equipment to the republic's natural and climatic conditions; a narrowminded departmental approach; lack of centralization of the creation and distribution of the computing center network and of computer equipment; the low level of software; the lack of a scientific production association for software, as well as of a republic algorithm and program bank; etc.

To eliminate these shortcomings, it is a good idea, in selecting specific types of computers, to analyze the following of their parameters: their structure (modular design, capability of parallel operation of machine units, quality and response of peripherals operating in conjunction); the capacity of memories; logical and mathematical structure; software; etc.

An analysis of the economic effectiveness of the development of the republic's computing centers must be approached from three main positions.

First, to substantiate the need for creating computing centers it is necessary to evaluate the results which are yielded by their territorial organization and by improvement of the control system, i.e., to compare costs and total savings.

A savings results from a gain in the total gross product in terms of cost, and on this basis, in net income in the form of a profit, reduction of losses in the production process, a better organized decision making process, intelligent distribution and utilization of labor and material resources and of fixed capital, improvement of labor productivity, and improvement of the control structure. According to our estimates, the presence of a territorial computing center has the effect of increasing total output and enhancing labor productivity by two to three percent, of lowering costs in the sphere of production and maintenance by five to 10 percent, and of increasing product quality by 10 to 18 percent.

Secondly, to select a combination of equipment and the appropriate computing process technology, a comparative estimate is needed of the time spent and the cost of processing information. Here it is recommended that use be made of the method of comparing costs with reference to the existing (using keyboard calculators and punched card machines) and the new calculating technology (using computers).

An estimate is made from the formula for annual imputed costs:  $Z = R + Y_e \cdot K$ , where  $Z$  equals annual imputed costs,  $R$  equals annual operating costs in

rubles per year,  $Ye_n$  equals the standard factor for the effectiveness of additional capital investment (in fractions of a unit per year), and  $K$  equals the capital investment in rubles.

The best variant, estimated by this formula, will be the one in which the size of annual imputed costs is the least.

Thirdly, to determine the size and type of computing center it is necessary to evaluate the advantages to be gained by an efficient combination of computing capacities, lowering of specific costs for scientific research, reduction of the need for specialists because of more centralized maintenance, lowering of costs for control because of a reduction in hierarchical levels, smoothing out of peak loads for equipment, and an increase in the overall and local workload for equipment.

Based on the conception described above, and applying it to the problem of forecasting and longterm planning for the creation of a system for offering computing services to the republic's control agencies at various levels, recommendations have been developed for the distribution of the network of republic, oblast and rayon VTs's in the Tadzhik SSR for the future.

Taking into account the distinctive features and specific nature of sectors, three general types of republic regional and sectorial computer centers are recommended for the Tadzhik SSR: a computing center belonging to a department; a regional computing center building its interrelationships with departments on a cost accounting basis; and an interdepartmental computing center in which are centralized only hardware services, while all other services belong to departments.

In accordance with this classification, a network of republic computing centers has been recommended and their functions have been determined. The orientation here has been toward improving the quality of control and enhancing labor productivity and efficiency.

Solutions have been recommended and justifications have been given for the organizational structure of VTs's, for staffs and for the key functions of subdivisions. Selection of types and estimates of the amount of hardware have been made by a diagnostic study of volumes of information when solving problems discovered on the republicwide level. In the process of analyzing indicators for computer equipment, recommendations have been given on the key characteristics of the information processing production process.

At the oblast level it has been suggested that oblast interdepartmental computing centers be set up. Location sites for them have been recommended. The main functions of oblast computing centers have been determined by an expert and diagnostic analysis of the work of oblast organizations. The organizational structure of VTs's has been established, recommendations have been given on their types, and the amount of hardware has been estimated.

At the rayon level it has been suggested that two types of computing centers be created: an interdepartmental computing center, and a computing center at which hardware services are centralized. Departmental centers can be set up at the group level. Types of projects have been developed and recommendations have been given on the location of VTs's in the Tadzhik SSR for the future. Based on the methodological approaches described above, recommendations have been developed for the longterm future development and location of computing centers for the Tadzhik SSR ministries of light industry, the food industry, and the meat and dairy industry, as well as for agencies for controlling agricultural production in the republic in the future. An arrangement has been suggested for general utilization of computer equipment on the basis of creating optimal routines for using it.

On the basis of research conducted on improving the effectiveness of the operation of VTs's in the socialist economy of the Tadzhik SSR, it is possible to make the following conclusions and recommendations:

1. It is advisable to make an analysis of the economic effectiveness of the operation of VTs's and of the utilization of computers in the socialist economy of the republic from three positions:

To evaluate the need for creating VTs's and for acquiring computers, an estimate should be made of useful results making it possible to improve the system of control as the result of solving a combination of problems.

To select the combination of VTs hardware and the appropriate technology for the computing process, estimates are made of time spent and the cost of processing information.

To determine the size and type of VTs, an evaluation is made of the advantages afforded by an intelligent combining of computing operations.

2. The enlargement of computing centers and centralized utilization of computer technology in the republic's socialist economy is an objective necessity, but the main indicator for the optimal size of VTs's in the Union republic's control agencies is designing of the computing process on the basis of specially sampled prepared problems, and of synchronous operation (output) of all kinds of equipment, which makes it possible to achieve high efficiency for the computing process and ensures its technical and economic effectiveness.

3. The main conditions for improving the effectiveness of the operation of VTs's and of the utilization of computers in the national economy are: matching VTs's with the control agency network; arranging for total utilization of computer equipment on the basis of creating optimal routines for using it; integrity and coordination of the functioning of all control units with VTs's; establishment of a unified technical policy and of a common information language; a proper combination of human activity with the operation of equipment; standardization of computing procedures; and an orientation toward model computing centers for the purpose of subsequent dissemination of their knowhow.



In the Tadzhik SSR it is a good idea to set up computing centers in which the utilization of computer equipment by ministries and departments is centralized, and other services belong to departments according to the existing hierarchical structure in the republic's control agencies. The most efficient organizational form for development of VTs's of this type is the scientific production association, which creates the best conditions for combining science with production and for economical functioning of special-purpose VTs's with group services for supplying them with hardware.

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## CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

### COMPUTERS FOR CONSTRUCTION PLANNING

Moscow EKONOMICHESKAYA GAZETA in Russian No 24, Jun 78 p 13

[Article by M. G. Chentemirov, first deputy chairman of Gosstroy: "On the Basis of Common Methods," in the series "Effectiveness of Automated Control System Utilization"]

[Text] We continue publication of articles based on materials of the Second All-Union Conference on the Use of Computers and Automated Control Systems in the National Economy (previous articles were published in Nos 22 and 23 of this weekly).

In his report at the 25th CPSU Congress L. I. Brezhnev said: "To build rapidly, economically and on a modern technical basis--these are the components of high effectiveness in capital construction."

This point made by L. I. Brezhnev, which was developed more concretely in his speeches at Plenums of the CC CPSU and in conversations with workers and the Party and economic aktiv during a trip through regions of Siberia and the Far East, has particular meaning for us.

About 11 million persons are now employed in construction. About 3,000 trusts and 29,000 construction and installation administrations are erecting numerous projects, and work is being done on the construction program by thousands of plants producing prefabricated reinforced concrete, metal structural units, parts and materials, and by hundreds of house- and plant-building combines and scientific research institutes.

This sector yields more than 10 percent of the gross national [obshchestvennyy] product and national income, being at the same time one of the largest consumers of material resources. Up to 40 percent of ferrous metals, more than 40 percent of lumber and wood-working industry output, 33 percent of fuel and energy resources and 13 percent of chemical industry output go for its needs.

This puts a great responsibility on management personnel and on each working collective for rational use of building materials and structural units and for ensuring the most rapid return on investments in fixed capital and in projects intended for housing, cultural and personal use.

#### Reducing Construction Time

In this regard it should be emphasized how important in the matter of capital construction is the implementation in the near future of the Party's directives on the need for strengthening the overall effect of the plan, of economic levers and incentives and of the whole system of management for enhancing the effectiveness of national production. Among the measures under preparation the central one is the move to planning and evaluation of an activity on the basis of final results--priority complexes and projects ready for operation.

Methods of material and technical supply and the use of economic incentives are being improved at all levels of management. The experience of the Minpromstroy [Ministry of Industrial Construction] of the Belorussian SSR is receiving fuller development under conditions of full cost accounting.

The complex of such tasks is being solved with the aid of ASU's of the Belorussian SSR Minpromstroy. Their implementation is providing an annual growth rate of 8 percent in volume of production, a 7 percent rise in labor productivity, a profit of 10 percent and by the end of the 5-year plan a 25 percent reduction in construction time.

Further development of new methods of planning and organization of work in all production units, from brigade to construction ministry, call for broad application of ASU's and computers. Presently, more than 480 systems functioning in a first-line capacity are in operation in the sector. They have been set up in union and republic ministries, territorial main administrations, construction and installation trusts and house-building combines, and in production enterprises. ASU's are solving more than 500 tasks in union and republic construction ministries and territorial main administrations, and about 250 tasks in enterprises.

With the use of computers annual and operational plans are formulated at all levels of management; material and technical resource requirements are determined; optimal schedules for furnishing projects under construction with prefabricated reinforced concrete, for delivery of mortar and concrete and for freight shipments are drawn up; operational information is developed on the conduct of the principal projects; and the economic activity relating to production of associations and enterprises is analyzed.

Special subdivisions concerned with questions of ASU establishment, and IVT's [computer information centers] have been created in all construction ministries and departments. Groups of specialists of about 200 scientific

research and planning and design organizations, "Orgtekhstroy" trusts and IVT's are participating in the development and introduction of systems.

In the ministries broad application is made of an automated system for monitoring construction work on the principal industrial projects. With its help last year the erection of more than 1,700 construction projects of various sectors, amounting to more than 8 billion rubles' worth of construction and installation work, was monitored in the USSR Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises], USSR Minpromstroy and USSR Ministroy [Ministry of Construction]. In order to analyze the information coming in from computer centers and to render needed help, joint coordinating centers are being established in general-contracting ministries, whose staff includes administrators and responsible representatives of the USSR Minmontazhspeystroy, client ministries and supply organizations of the USSR Gosstab. This permits concentration of efforts on priority projects and a substantial reduction in their start-up time.

#### Broad Application of ASU's

It is instructive that the greatest success is achieved by organizations making rational use of computers. Among them one may cite the Minpromstroy of the Belorussian SSR, Mintyazhstroy of the Ukrainian SSR, Ministroy of the Lithuanian SSR, Glavmosstroy [Main Administration for Housing and Civil Engineering Construction in Moscow City], Glavleningradstroy [Main Administration for Housing, Civil Engineering and Industrial Construction of the Leningrad Gorispolkom], Bratskgesstroy, Trust No 36 of the USSR Ministroy, and "Kurganzhilstroy" of the USSR Mintyazhstroy.

The Mintyazhstroy of the Ukrainian SSR has worked out and successfully introduced a modular method of preparing, organizing and managing the construction of large industrial complexes by using computers. Essentially, it consists of breaking down the complexity of an industrial complex into individual constructional and technological modules whose construction times are interrelated. Subsequently, schedules for delivery of all types of resources are developed for each of them. On this basis, all engineering specifications for production setup, organization and control of the construction are worked out in detail using computers. The method's effectiveness has been confirmed during erection of a "3600" mill at the "Azovstal'" Plant, of the pipe arc welding shop of the Khartsyzsk Pipe Plant, and of blast furnace No 9 at the "Krivorozhstal'" Plant.

The experience of Mintyazhstroy of the Ukrainian SSR is spreading more widely. Last year it was employed in the construction of 168 large industrial complexes amounting to 737 million rubles' worth of annual construction and installation work. This year it is being used on 190, having an annual volume of work amounting to 1,136 million rubles. Application of this method permits construction time to be reduced substantially; it improves the utilization of the production capacities of construction and installation organizations; and it raises technical and economic indicators of their work.

Broad use is being made in the sector of a system of calendar planning created by Estonian construction workers. It enables the formulation of an optimal construction program for trusts and administrations, by which uniform and regular work by brigades and rational use of material and technical resources are ensured. Last year the system was employed in more than 30 organizations of Glavkrasnoyarskstroy and Glavsevkavstroy and in several other organizations, totalling annually about 650 million rubles' worth of construction and installation work. The economic effect exceeded 10 million rubles.

Definite successes have also been achieved in the use of computers for planning the production and deliveries of prefabricated reinforced concrete products. Thus, ASU's in the trusts "Donbassenergostroykonstruktsiya" and "Mosenergostroykonstruktsiya" contribute to improving the economic activity of production of 23 large plants producing prefabricated reinforced concrete articles. Using computers, tasks are solved in planning the production and assignment of product types among plants; in monitoring the production and delivery of reinforced concrete articles; in material and technical supply; and in accounting and record-keeping.

The pay-off period of the ASU's established in the construction sector comes to 1 and 1/2 to two years, significantly less than the standard period of return on capital investments for establishment of ASU's during 1976-1980 set by the USSR Gosplan.

#### A Progressive Form of Computer Exploitation

The USSR Gosstroy and the construction ministries have been devoting much attention to developing the technical base of management. The policy is being pursued of developing the technical base of automated systems and automating of scientific research and design efforts by reequipping and expanding computer centers now in operation.

The creation of a number of computer centers for collective use is planned, based at large institutes, which are intended to serve the sector's scientific research and design organizations. The establishment of group computer centers is provided for in order to supply the needs of construction organizations located on the territory of given regions, regardless of departmental subordination. This will reduce expenditures for introduction of computer hardware and enhance the effectiveness of computer utilization.

The main directions for heightening the effective introduction of ASU's in construction have been fixed by the 10th Five-Year Plan work program. It is the fundamental methods and organization document in the sector, governing the move toward the elaboration and broad utilization of model design solutions and regulating the establishment of ASU's in the base construction ministries, departments and organizations.

The elaboration and adoption by sectorial commissions and the implementation on a broad scale in production of about 50 model design solutions for ASU tasks are currently specified. The creation of systems is being completed in all union-wide and union-republic construction ministries, in 12 republican ministries and territorial main administrations, as well as in many enterprises of the industry and motor transport enterprises, and in scientific research and design institutes. This effort is furthered by the policy we are pursuing of specialization of ministries and scientific research organizations in the matter of developing ASU subsystems and task complexes and subsequent wide sharing of them. Thus, out of 15 subsystems being developed in ASU programming, two are assigned to the USSR Gosstroy, four each to the USSR Mintyazhstroy and USSR Minpromstroy, three to the USSR Minstroy, and two to the USSR Minvudkhov.

Sectorial commissions on the operational adoption of subsystems have been created in the lead ministries. For coordination of activities an Interdepartmental Commission on Improving Construction Management Through the Use of Computer Equipment and Control Systems has been organized in the USSR Gosstroy.

Measures are specified by the USSR Gosstroy for the study and solution of intersectorial and interdepartmental problems of construction management (links between design work and construction, general-contracting and sub-contracting ministry activities, and construction clients and suppliers of material and technical resources). By 1980 a number of system-wide developments will have been completed in the sector, governing ASU establishment in construction (standardization of documentation and indices; development and use of standardized documentation systems and information classification and coding; and use of a sectorial store of model design solutions).

Unity of method in supplying the branch with necessary materials for guidance and methods on the study, generalization and dissemination of advancements is gaining scope and importance. Increased effectiveness in ASU establishment also depends in large measure on other departments and organizations.

The further development of group computing centers requires the resolution of a number of organizational matters including determination of their organizational arrangement, furnishing of hardware and financing.

Attention should be paid by planning organizations and corresponding departments to the fact that until now series output of [air] conditioners [konditsionery] and other machine room equipment has not been set up in the necessary quantity and quality, and this has led to great difficulties and losses of time in the establishment of computer centers.

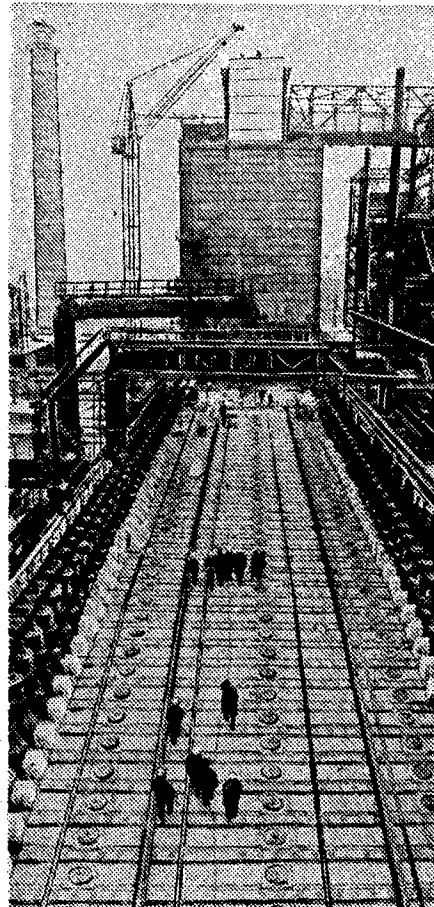
Construction workers expect reliable devices for transmission, processing and output of information in teleprocessing and man-machine dialog modes

from the Ministry of Instrument Making, Ministry of the Radio Industry and Minelektronpro, which will enable construction administrators of all levels to solve operational problems of concentrating energy and resources on the most important portions and making rational use of materials.

Prompt assistance in solving theoretical and system-wide problems and in furnishing packages of applied programs and operational systems is not always given by the Ministry of Instrument Making, the Ministry of the Radio Industry and other ministries and departments.

For a long time there has been no solution by the USSR Gosplan, the State Committee for Science and Technology and the USSR Ministry of Finances of problems for financing ASU developments carried out by design institutes or for arranging the structure and staffing of computer centers in construction organizations.

Implementation of the work program in the construction sector aiming at improvement of the management of capital construction using computers and mathematical and economic methods will favor the unconditional and effective fulfillment of the tasks facing construction workers in the 10th Five-Year Plan.



[Photo legend on following page]

[Photo legend, p 13] The ninth coke-oven battery was recently started up at the Cherepovets Metallurgical Plant. Now that the new unit has gone into operation the plant will manufacture about 720,000 tons of additional high-grade coke per year. The ASUTP [automated technological process control system] has been improved on the new battery. It will increase products quality considerably.

Shown: the central unit of the ninth coke-oven battery before start-up.

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## GEOPHYSICS, ASTRONOMY AND SPACE

### POLISH 'SALYUT' EXPERIMENT PROGRAM DESCRIBED

#### Semiconductor Crystallization

Warsaw ZYCIE WARSZAWY in Polish 29 Jun 78 Special Edition p IV

[Article by Dr Robert R. Galazka, Institute of Physics at the Polish Academy of Sciences]

[Excerpt] Dr Robert R. Galazka is the originator of the technological experiment called the "Syrena" project, which the Polish cosmonaut will perform on board the Soviet orbital laboratory "Salyut-6."

The experiment is to crystallize semiconductors of the HgCdTe type from the liquid phase under zero-gravity conditions. The object of this experiment is to study crystallization processes under zero-gravity conditions and, especially, to produce homogeneous alloys of such semiconductors.

Mercury, cadmium, and tellurium have very different atomic weights. Convection due to gravity greatly impedes the formation of homogeneous alloys of these elements under terrestrial conditions. On the homogeneity, meanwhile, depend the physical properties of the end product and, consequently its practical applications.

The experiment will be performed in the Soviet "Splav 01"-type apparatus. An HgCdTe crystal, grown in the shape of a cylinder and placed in a quartz flask under high vacuum, will be melted in a zero-gravity environment. Its temperature will then be lowered according to a definite program. As a result, the material should solidify in a controlled manner. After the crystallization process has been completed, the product will be taken out of the furnace and returned to earth.

Semiconductor crystals of the HgCdTe type have been studied for many years at the Institute of Physics at the Polish Academy of Sciences. Let us define here their properties and possible applications. Semiconductors of this type are at the present time known as the best detectors of infrared radiation.

Their high sensitivity and, even more, their low inertia facilitate the reception of very short (nanosecond) signals, which makes many new applications feasible. Such HgCdTe devices can detect radiation within 10  $\mu\text{m}$  band, i.e., within the so-called atmospheric window, because radiation within this band is not absorbed by clouds and other gases. The materials can also be used for the construction of semiconductor masers (infrared) or halotrons. We expect the HgCdTe-type semiconductors produced under zero-gravity conditions to be crystallographically more homogeneous and more nearly perfect than those produced on Earth.

"Syrena" is the name given to the Polish technological experiment to be performed on board the "Salyut-6." It is one of the experiments which the Institute of Physics proposed for the INTERKOSMOS program (at the First Conference on Problems of Space Technology in May 1977 in Moscow). It is noteworthy that this will be the first technological experiment in history to be performed with such a ternary compound in outer space. It will be performed in collaboration with the Institute of Space Research at the USSR Academy of Sciences in Moscow.

The rapid progress in space technology brings us closer to the era when various materials for industrial use will be produced in orbit around the Earth. In the opinion of some experts, tons of various materials will be produced in outer space by the end of this century. All this indicates that we will soon witness the birth of a new branch of industry, namely an industry set up for the production of new materials with better and better properties. These materials will, in turn, contribute to further progress in science and engineering.

The "Syrena" experiment on board the "Salyut-6" is the contribution of Polish scientists to hastening this progress.

#### Space Medicine, Psychology

Warsaw ZOLNIERZ WOLNOSCI in Polish 28 Jun 78 pp 3, 5

[Article by Col Stanislaw Baranski, commandant, Military Institute of Aviation Medicine]

[Text] What will the Pole be doing in orbit? Zolnierz Wolnosci addressed this question to Col Stanislaw Baranski, commandant of the Military Institute of Aviation Medicine, professor, doctor and a prominent expert in the field of aerospace medicine, also a coorganizer of preparations for the space flight to be undertaken by the first Polish cosmonaut.

We have prepared for our cosmonaut a research and test program which is rather broad in scope and scientifically important. It covers as many as 12 subject matters, including 9 in the field of medicine, physiology, and psychology, 2 in the field of physics and space technology, and 1 in the field of earth science or, more precisely in photography of the Polish territory for various uses in science and the national economy.

It is worth recalling that the scientific experiments designed for performance in orbit constitute only a part of the entire complex flight program. Our cosmonaut is a member of the crew and, therefore, must together with the Soviet cosmonaut (who is commander of the space vehicle) perform such duties as astral navigation, operation of the equipment on board, maintenance of communication links with the Flight Control Center, etc.

I would like to briefly describe the contents of the orbital experiments which we have entrusted to the Polish cosmonaut. For a long time now, since almost the very beginning of manned flights, cosmonauts reported a strange phenomenon: a change in taste during sojourn in orbit. The symptoms were felt especially during lengthy flights. Despite steady improvements in the makeup of the space diet with a more diversified menu, cosmonauts did not cease complaining about taste irregularities. Reading the diaries and notes of some cosmonauts, one could very well be left with the impression that these cosmonauts reacted like "spoiled children." It is difficult to draw analogies here, but the fact remains that a man in orbit thinks he would like to eat a meal having the taste and the characteristics of, say, his favorite cucumber soup. He will prepare himself such a meal to enjoy in the "space ship", but while eating it he will not feel the "cucumber" taste and get a craving for something else.

This phenomenon is, to some extent, associated with the state of weightlessness, with the mixing of fluids inside the organism, and has undoubtedly an effect on the sensitivity of, let us call them simply, taste receptors spread over the surface of the tongue tip.

At the Military Institute of Aviation Medicine, therefore, an apparatus for electrogustometric studies has been built which can quantify the threshold of taste perception. This apparatus, called an "electrogustometer," consists of a generator of linear voltage for varying the current between electrodes over the 0-200 mA range, a digital measuring device, and two electrodes (one applied to the man's wrist and the other applied to the tip of his tongue). After several repeated measurements, with proper calibration, it is possible to establish the taste sensitivity threshold. A team under the direction of Dr Janusza Kubickowa, which had developed this apparatus, performed experimental tests at the Laryngological Clinic of the Military Institute of Aviation Medicine prior to handing it over to the cosmonaut.

If the experiment with this "electrogustometer" in orbit confirms our hypotheses, we hope that future cosmonauts of the great "interkosmos" club will continue it.

For proper dosage of physical training in orbit, i.e., for regulating heart activity we have adapted a miniature device called a "cardioleader." Placed on the chest, it regulates the training tempo, for instance, by generating acoustic signals of deviation from the preset level. The cosmonaut, equipped with a cardioleader can himself regulate the required training tempo. In the future this principle may be applicable also to automatic control of the

moving track on the "Salyut-6." The most important experiment in the field of space medicine, now performed by us jointly with the Soviet Union, includes testing the cosmonauts before launching as well as during flight and during landing; it covers the performance of the cardiovascular and the respiratory system under dynamic conditions. We have adapted for this an apparatus called "physiotest," which had been developed at the Military Institute of Aviation Medicine and which can simultaneously record parameters of seven states of a human organism under dynamic conditions. The results of these tests can be displayed on an oscillograph screen, recorded on a magnet tape, indicated digitally on a luminous panel, and transmitted to a computer for a precise analysis of changes in the cardiovascular and the respiratory system. The apparatus can be connected to the moving track and to a cyclergometer, for authentic regulation of the heart activity, the track speed, the inclination angle, etc. This "physiotest" will be used for prelaunch testing of the Soviet and Polish cosmonaut, we will also use it for postlanding tests and during the debriefing period.

The subsequent two experiments we will perform jointly with Soviet specialists, as a continuation of Soviet research begun earlier. The object of one of them is to test the responses of man's constitution to the use of "Czybis" decompressing suits in the state of weightlessness. The other experiment deals with determining the blood distribution under zero-gravity conditions. These two items are interrelated and they constitute a certain entity within the continuous test series whose aim is solving a problem of great importance to the future of cosmonautics, namely, the preparation of a man for long space flights.

Jointly with the Soviet Union and Czechoslovakia, we will study the heat transfer in an organism under zero-gravity conditions. The absence of air movement may inhibit heat transfer in some parts of the human body. Without dwelling too long on this subject, let me only point out that we have undertaken an experiment with the use of temperature-holding sensors. Another Soviet-Polish-Czechoslovak experiment in the field of space medicine concerns oxygen processing under zero-gravity conditions. Oxygen depletion is measured here polarographically.

In the field of space psychology we have developed, jointly with the Soviet Union, a "log book" which we hope will give us an objective evaluation of the effects of various factors on man's performance during a long orbital flight. The data recorded in this "diary" will include, among others, fitness for activities under zero-gravity conditions, ability to communicate with other members of the crew, processes involved in visual perception, work and rest rhythms, use of medications and their effect on the feeling or well-being, etc. In the field of psychology we will also perform tests dealing with recreation. On the basis of research on individual interests and tastes of cosmonaut's, Col Romuald Bloszczyński (director of the Department of Psychophysiology at the Military Institute of Aviation Medicine) has prepared a 4-hour recreation program and put it on magnetic video tape. This program, when followed during flight, will make it possible to evaluate the effect of

this form of recreation on a cosmonaut's feeling of well-being. Debriefing information gathered after the flight will then provide a basis for new programs and new methods of their implementation. This much, in a nut shell, about medicine and psychology.

Experiments in the field of engineering have been designed by the Institute of Physics at the Polish Academy of Sciences. They generally deal with the feasibility of producing, under conditions of vacuum and zero terrestrial gravity, crystals and other materials which cannot be produced on earth. Photographing the earth, on the other hand, will be done not only experimentally but also as a practical job for the benefit of science and the national economy.

The forthcoming flight is an attractive event, not only from the standpoint of research but also as one requiring of our cosmonaut a high degree of operative-motor fitness as well as mental concentration. We know our cosmonaut Maj Mirosław Hermaszewski very well, his personal virtues, his diligence and perserverance, inspiring in us the confidence that the experiments will be carried out successfully.

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## GEOPHYSICS, ASTRONOMY AND SPACE

### POLISH COSMONAUT SELECTION PROCESS DESCRIBED

Warsaw SLOWO POWSZECHNE in Polish 28 Jun 78 p 3

[Interview with Col Dr Romuald Bloszczyński, Military Institute of Aviation Medicine by Stanisław Remuszko]

[Text] What are the criteria for selecting cosmonaut candidates? What psycho-physical characteristics must they possess? We are discussing this subject with a scientist who has conducted special tests on a group of Polish pilots, namely, Col Romuald Bloszczyński of the Military Institute of Aviation Medicine.

[Question] Doctor, perhaps you will begin by telling us about the beginning.

[Answer] We had selected a large group of scores of pilots from among military supersonic-aircraft personnel. All those in that group have had a great deal of professional experience and were in excellent health. Following preliminary tests at the Military Institute of Aviation Medicine, we reduced the group to about 20 persons and assigned them to aviation conditioning centers in Mazury and in Zakopane for 2 months of training, the purpose being to equalize the pilots' performance characteristics so as to establish a uniform comparative basis for the third selection stage.

After training in camps where medical and psychological tests were performed in parallel, there were only 12 candidates left. Those were subjected to a cycle of all-encompassing tests sequentially administered by teams of specialists. From final discussions and composite analyses there evolved a point list according to which four pilots were selected for additional testing in the Soviet Union. The results of those tests were favorable: All four were recognized as being completely fit for space travel. Our government decided to assign two of them to the basic training of cosmonauts, as official representatives of Poland.

[Question] The evaluation by Soviet specialists with many years of experience in cosmonaut selection thus agrees with your evaluation, which must be a pleasing confirmation of the correctness of the test programs and of the

selection methods established at the Military Institute of Aviation Medicine. I would like to ask you now, Doctor, to which psychophysical characteristics of candidates did you pay special attention?

[Answer] The tests were all-encompassing, but actually three questions were most crucial. I have in mind capability of the circulation system, effectiveness of the balancing organs, and resistance to stress. These are the factors of extra importance to be considered under space flight conditions.

We subjected the candidates' organisms to tests such as, for instance, in centrifuges, under variable load in a so-called cyclergometer, etc. Throughout the tests we recorded various physiological parameters such as ventilation of the lungs, pulse, pressure, and the electrocardiogram. On special spinning chairs and other devices we tested the behavior of their balancing organs under perturbations. In low-pressure chambers we determined their so-called system reserve capacity for conditions of heavy oxygen depletion. There are only examples of tests, by the way, an exhaustive description would fill a few hundred pages.

[Question] In the public's perception a cosmonaut seems to be, in terms of physical and mental fitness, something like a superman. How much do pilots of space vehicles deviate from the average social norm?

[Answer] One can hardly say that they deviate. They are just ideally and perfectly healthy, unlike normal healthy citizens in whom, however, certain slight, though harmless, deviations can almost always be detected. Such an ideal health specimen represents the entire population of military pilots (the criteria are very stringent here), while the cosmonauts selected among them represent "the best of the best."

[Question] And what about resistance to stress? Could you give an example of this type of tests?

[Answer] With pleasure. Well, during the tests we launched our candidates in a manner simulating, for instance, an emergency descent of an airplane. This is an unpleasant experience, the load reaches a 14 to 16 g level within a fraction of a second; meanwhile, the waiting time and the "shot" itself constitute a heavy psychological and physical burden on the pilot.

On the day of launching we performed many physiological measurements: a few hours before "starting," then just before and just after bailing out. Although all candidates ranked high according to stringent standards, some essential differences became apparent within the test group: their system responses had reflected a somewhat different behavior of each pilot during confrontation with real danger.

Differences also became apparent during psychological tests, during which physiological data were also recorded. The question posed was: When two men attain the same test results, then how much effort have their organisms

exerted? The man who attains these results with less effort is obviously the better one, inasmuch as he retains a larger reserve capacity for coping with extreme circumstances.

[Question] What were the I.Q. scores of our cosmonauts?

[Answer] Excellent. We applied, among others, the Wexler norm adapted to the overall Polish population. The results fell within the 130 to 135 range, the norm for an adult person being 100. Scores like those of the cosmonauts are reached by hardly a few percent of society.

[Question] Stanislaw Lem has described, surely on the basis of authentic scientific experiments, some prodigious responses of the psyche and tricks of fantasy of a man living for long periods of time alone in the cosmic vacuum. Will you permit me, in conclusion, to ask how our pilots are protected against this.

[Answer] Of course, these so-called eidetic responses of the imagination under space flight conditions are known to scientists. One of the Russians reports, for instance, how after having been in orbit for a long time he suddenly heard the bark of a dog and the cry of a child, whereupon he saw ...indeed!...the child's mother calming it. Responses of this kind are a consequence of mainly two circumstances: 1) sensory deprivation, i.e., limitation of the amount of external stimuli, and 2) social isolation (one lives here, after all, for many weeks in the company of one or, at most, two other persons). Such illusions are also fostered by the space limitation inside a craft, the lack of domestic comfort, the state of weightlessness, etc.

One copes with it by various methods and with various means. We inform the candidates, for instance, about likely perturbations; one suffers much less when the mechanism and the causes of perturbations are known. At the same time, as the art of space travel is progressing, we note a trend toward an organized leisure time in which the pilot engages in some interesting as well as relaxing activity. For diversion during flight there are established regular communication links with family and colleagues, even chess tournaments were arranged across the distance from Earth to satellite in orbit.

For this very purpose, the pilots of "Salyut" have been equipped with magnetic videotapes and a monitor. Like the other pilots, our compatriot took with him film and music cassettes with performances of his favorite artists. The time in orbit will certainly not be boring.

[Slowo Powszechnie] Thank you very much for talking to us.

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## GEOPHYSICS, ASTRONOMY AND SPACE

### DEVELOPMENT OF MODERN SPACESUITS

Moscow NAUKA I ZHIZN' in Russian No 6, 1978 pp 40-46

[Article by Professor G. Il'in, Candidates of Engineering Sciences V. Ivanov and I. Pavlov]

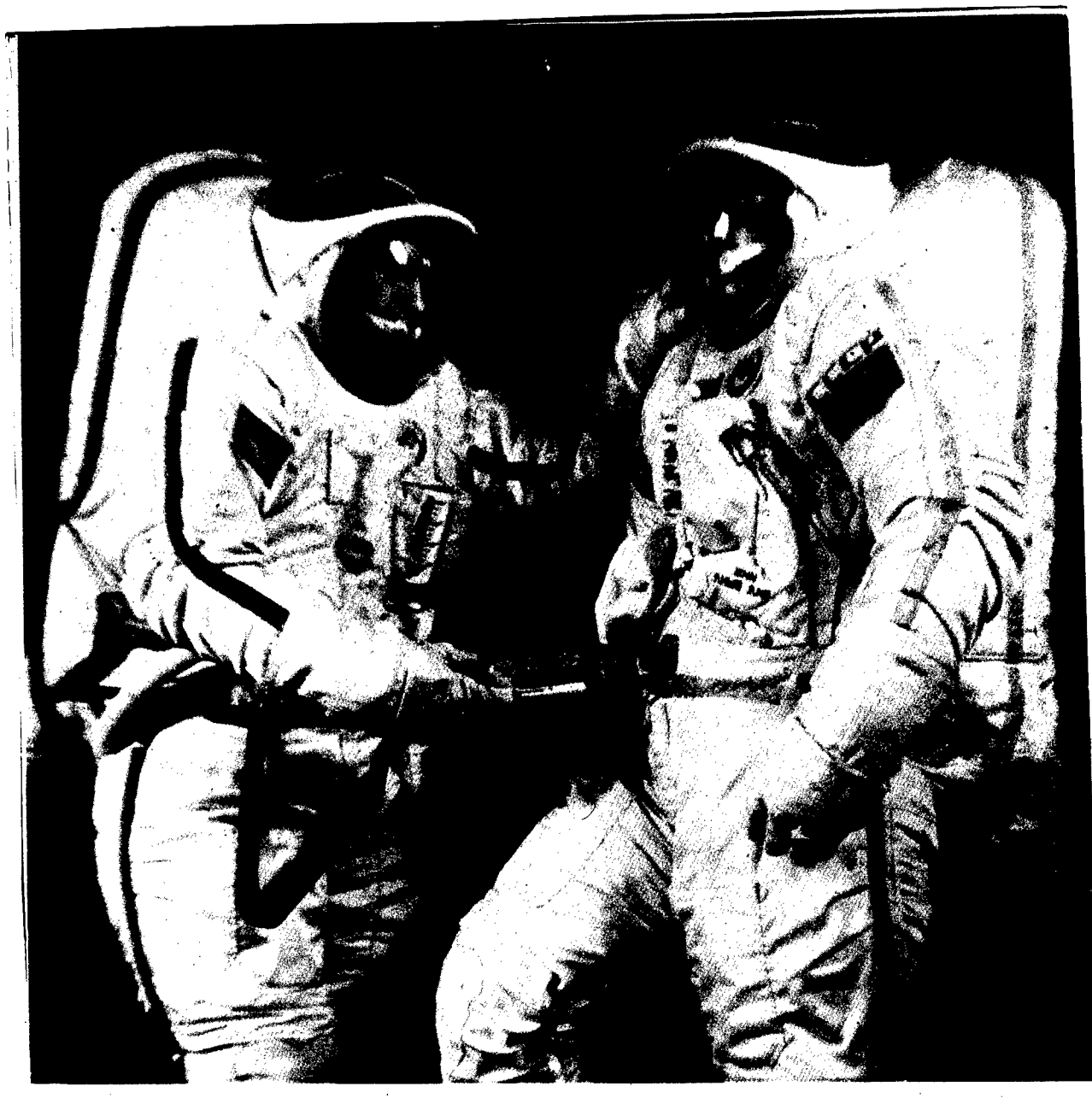
[Text] Each of us, on television, films or photographs, has seen how cosmonauts enter rockets in the launch position in their space clothing, or spacesuits. But certainly not everyone can accurately answer the simple question why must a cosmonaut wear a spacesuit? What is the specific purpose of this confining equipment? And, in particular, why must it be worn in a spaceship, where all conditions necessary for life and work are maintained?

The human body is adapted to life in the earth's atmosphere and cannot exist outside of it without special means of protection and without the creation of an artificial inhabitable environment. The chief means of protection of cosmonauts from hazardous factors in space flight is the spaceship itself, its hermetically sealed cockpit. However, flight safety requirements sometimes make it necessary to use personal safety equipment, for example on those occasions during flight when the possibility of rupture of the seal of the cockpit or failure of the on-board life support system must be taken into consideration, and when a cosmonaut leaves his spaceship and goes out into open space his spacesuit is his only means of protection.

Let us now proceed from these general considerations to the specific factors that determine the need for such safety equipment as a spacesuit.

#### Man in Airless Space

As is known, barometric pressure decreases with distance from the earth's surface. If normal pressure at sea level is 760 mm mercury, it is one-fifth of that at an altitude of 12 km, and one-thousandth at 50 km. The pressure at orbital space flight is approximately  $10^{-6}$ - $10^{-8}$  mm Hg, i.e., billions of times less than on the earth.



Testing space equipment in semihard suits, designed for working in open space on the "Salyut-6" orbital station. Photo by A. Mokletsov.

Oxygen, which is vital for human life, is absorbed from inhaled air and carbon dioxide is simultaneously eliminated from the body during the respiration process. Man pumps up to 450 liters of air per hour through his lungs, even when resting. The oxygen concentration in the atmosphere is 21% by volume and remains virtually constant with altitude. Therefore oxygen always accounts for approximately one-fifth of the atmospheric

pressure, which on the earth's surface is 160 mm Hg. And throughout millions of years of evolution all of our sophisticated physiological systems have been adapting to the absorption of oxygen at specifically that pressure.

Total barometric decreases and the partial pressure of oxygen (the fraction of the total pressure of a mixture of gases attributed to a given gas or vapor) decreases along with it as altitude increases. "Oxygen starvation" occurs. To get the necessary amount of oxygen man begins to breathe more frequently and deeply, and if there is too little oxygen he loses consciousness. Our body has virtually no reserve of oxygen, and therefore if man can live without food for months and without water for up to 14 days, he can live without oxygen for only a few minutes at the most.



Spacesuit of "Salyut-6" orbital station for working in open space.

In addition to oxygen starvation there are other factors that hamper or prevent man from living under low pressure conditions. In particular, when the atmospheric, i.e., external pressure falls to the level corresponding to an altitude of 7-8 km the nitrogen that is dissolved in the tissues of the body changes to the gaseous state. The gas bubbles that form can block circulation to vital organs or cause pain by exerting mechanical pressure on nerve endings (decompression sickness). Body liquid can boil off at even higher altitudes. The water in the tissues, even at a pressure of about 47 mm Hg (this corresponds to atmospheric pressure at an altitude of 19.2 km) begins to boil off at 37°C, which is the normal body temperature.

To prevent oxygen starvation oxygen is added to the inhaled air and its concentration is increased so that the partial pressure of oxygen is maintained at the customary 160 mm Hg. In aviation, in particular, oxygen respirators with a mask or pressurized suit are used for this purpose. However, at an altitude of just 12 km, where the total pressure is only 145 mm Hg, even pure oxygen cannot provide the required partial pressure. At an altitude of 16 km man breathing pure oxygen loses consciousness in just 15 seconds.

The following conclusions can be drawn from what was said above: in order to fly at high altitudes it is necessary to increase the total pressure of the gas in which man lives and breathes, i.e., it is necessary to create an environment with excess pressure, exceeding atmospheric pressure at a given altitude. This is one of the main problems that is solved with a spacesuit. The sealed shell provided by a spacesuit isolates man from the external environment, and an artificial atmosphere with excess pressure and with the required gas composition is established inside the suit.

The excess pressure in the atmosphere inside the suit should be sufficient to provide the required partial pressure of oxygen and to prevent decompression sickness. At the same time the pressure should be low enough to promote mobility inside the suit. The working pressures in modern spacesuits fall within the range of 180 to 300 mm Hg. The artificial environment inside the spacesuit need not necessarily have all the properties of the earth's atmosphere to which we are accustomed: if a man wears a suit for a comparatively short time the known reserves of the human body, which enable him to survive without harm conditions that differ somewhat from normal, can be relied upon.

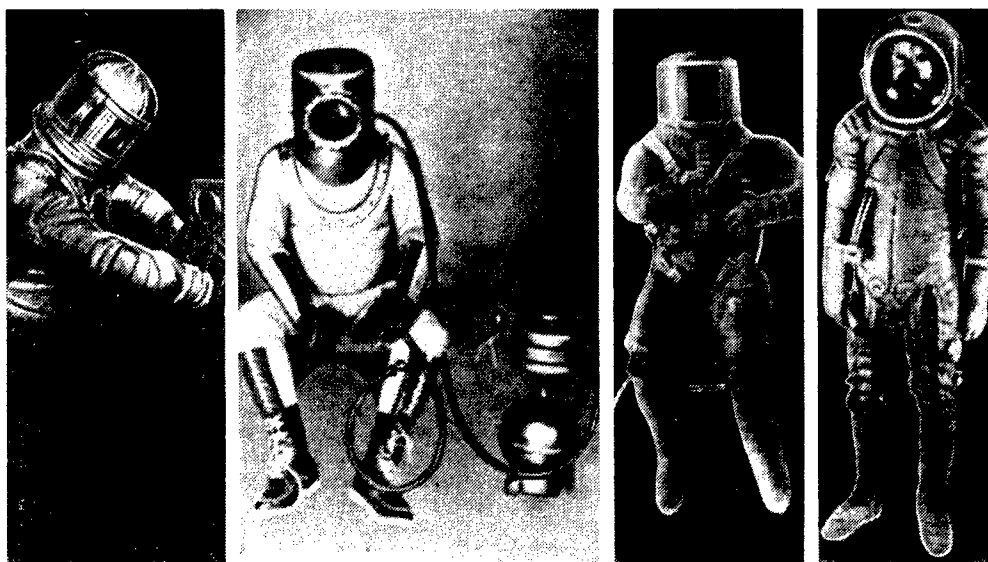
Problems, Problems...

Work on the development of suits for high-altitude flights began more than 40 years ago, and our country was one of the pioneers in this effort. High-altitude suits have come a long way, from the immobilizing reinforced pressurized one-piece work suit to sophisticated systems with improved life support systems, systems that incorporate the latest achievements of modern technology, materials analysis, chemistry, electronics and other fields of technology.

The development of modern spacesuits, particularly those designed for working in outer space, required the solution of a number of difficult scientific-engineering problems. It was necessary, in particular, to establish the proper microclimate in a suit (pressure, gas composition, humidity and temperature) in consideration of possible emergency situations. It was necessary to protect the cosmonaut and spacesuit equipment from the effects of profound vacuum and solar radiation. It was necessary to vent body heat, which is not an easy thing to do under the conditions of space. And, finally, it was necessary to give cosmonauts mobility, the ability to work, which, of course, was difficult due to the excess pressure in spacesuits. The suit must be airtight, strong, lightweight, compact and safe. To this must be added the mass, so to speak, of auxiliary needs, for example the development of ways of simulating external factors in space and space-walk conditions during tests on the earth, or the development of materials suitable for the conditions of open space.

The important characteristics of a spacesuit are the time it takes to get into it and the ease with which one can work in it. During extended flights on orbital stations, when the program may call for a change of crews and

several spacewalks for work in open space, additional requirements are imposed on spacesuits. For example, it should be possible to "adjust" a spacesuit for cosmonauts of different heights. A spacesuit should be able to be repaired or individual parts of it replaced if need be.



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Examples of first high-altitude pressure suits (from left to right): the Ch-3 pressure suit (USSR, mid 1930's); Willy Post's pressure suit (United States, mid 1930's); the SK-TsAGI-8 pressure suit (USSR, 1940); the VSS-04 pressure suit (USSR, 1950).

### Shelter from the Sun

The work that a man performs in a spacesuit outside of the spaceship is usually considered in calculations to be moderate labor, requiring an average energy of 300 W. This energy expenditure corresponds to the following vital signs of the body: an oxygen consumption of approximately 60 liters/hour, carbon dioxide discharge of 48 liters/hour, moisture discharge of 50-300 g/hour (depending on the ambient temperature and method used to cool the body).

The required climatic and hygiene conditions are maintained in a spacesuit by an independent life support system, abbreviated ASOZh, which is an inseparable part of a spacesuit. The specific functions of ASOZh are to maintain the prescribed pressure and gas composition in the suit, remove the products of vital activities and maintain the required humidity and temperature.

The problem of maintaining the proper heat balance is a particularly difficult one. Because of man's low efficiency, which usually does not exceed 20%, all the power he develops, these average 300 W, are practically

all transformed into heat. No appreciable exchange of heat between a cosmonaut wearing a spacesuit and space takes place; in space there is no air and no heat-conducting medium, which under terrestrial conditions withdraws heat from our bodies. Nor is there any convection inside a spacesuit under conditions of weightlessness. There is only one other means of heat transfer, and that is thermal radiation. It must be taken into consideration here that a cosmonaut outside of a spaceship can work either in sunlight (a spacesuit in open space receives up to 1,200 kcal/hour of solar heat per square meter of area), or in the shade, under the severest cosmic cold conditions. Therefore the flow of heat into the spacesuit or from out of it can fluctuate wildly, reaching great magnitudes.

To protect man and equipment from such abrupt changes of heat flows the main shell of a spacesuit is covered with several layers of cloth, forming what is known as a vacuum-shield heat insulation, which functions as a kind of laminated thermos flask. Also, the optical properties ("blackness," a parameter that characterizes the emissivity of the body, and the solar radiation absorption factor) of the materials of the exposed surfaces of a spacesuit are selected in consideration of certain conditions, and special paints are also developed for them. The materials and coatings are selected such that external radiation is nearly entirely reflected, and at the same time the internal human heat radiation is retained. The importance of this problem is further related to the fact that elastic materials are needed for the soft parts of the suit, and they do not always withstand large temperature drops.

The composition of solar radiation in open space, outside of the atmosphere, differs substantially from what we are accustomed to on the earth's surface. Therefore special requirements are imposed on the transparent part of the suit: glazing and light filters must protect the eyes and facial skin from extremely strong ultraviolet and infrared (thermal) rays, must attenuate solar radiation in the visible part of the spectrum and at the same time provide good visibility in different degrees of illumination.

#### The Microclimate in a Spacesuit

The easiest way to maintain the required gas parameters inside spacesuits is continuous ventilation, the continuous supply of a gas mixture with the required composition inside the suit and discharge of this mixture into the surrounding space. In such a system the gas mixture itself carries away the heat, moisture, carbon dioxide and wastes released by a cosmonaut. This kind of system, called the "open type" is usually worn in high-altitude airplanes, where air from the surrounding atmosphere can be used for ventilation, and only the oxygen required for breathing need be supplied to it. This kind of system is very simple and reliable. However, open systems are too inefficient to be used in a spacesuit. In space, of course, there is no air, and therefore the supply of gases required for ventilation must be brought along in cylinders. The additional space and weight required for this are considerable to say the least.

Nevertheless, open life support systems were used by A. Leonov in the first spacewalk and for work outside of the spaceship in the United States "Gemini" program, in which cases the time spent working in the spacesuit outside of the ship was brief and the total gas consumption was completely acceptable.

Regenerative systems, in which the gas circulates through a closed loop, and not all the gas inside the suit is regenerated, but only the components that are exchanged or used up in vital activities, are used mainly in modern spacesuits. After being regenerated in ASOZh the gas mixture is recharged with oxygen and is used again for breathing and ventilation.

As we have already mentioned, maintenance of the proper heat conditions causes special worries for designers during the development of the microclimate inside of a spacesuit. Suffice it to say that even a comparatively minor "heat exchange deficiency" of only 150 kcal/hour for a man weighing 70 kg wearing a spacesuit, causes his body temperature to rise by more than 2°C per hour. This entails a loss of ability to perform work.

Heat can be transferred from the human body to the cooling system of ASOZh both with gas (air) and with liquid. When air cooling is used heat is taken from the body mainly as the result of heavy perspiration, and this, of course, is a serious deficiency. Furthermore the removal of heat from a cosmonaut engaged in heavy labor requires that an extremely large volume of gas, for example 700-1,000 liters/min, be pumped through the spacesuit. This, in turn, requires a fan with a power of several hundred watts, which uses a large amount of electricity, and the strong air flow is not very comfortable for the cosmonaut.

Water cooling is perhaps the only possible way of maintaining acceptable heat conditions inside a spacesuit during heavy labor. The flow rate of water through a water-cooled spacesuit for removing 300-500 kcal/hour of heat is usually 1.5-2 liters/min, and the required length of cooling tubes ranges up to 100 meters. A pump motor with a power of a few watts is perfectly adequate for pumping the water. Ventilation is also necessary in addition to water cooling; it carries off moisture and carbon dioxide released by the cosmonaut, but in this case, of course, the power of the fan motor is many times less than for pure air cooling.

#### Mobility in a Spacesuit

Different kinds of clothing encumber man's mobility to different degrees. Notice how easy it is to raise your arm in one lightweight shirt, and how hard it is in a winter coat. A spacesuit poses particular resistance to movement of the body. Its soft lining, under the influence of excess internal pressure, always tends to acquire the shape of a body of revolution and straighten out. It is not so easy to bend some part of it, let us say a sleeve or a leg, and the higher the internal pressure the more difficult this becomes. Hinges, installed in the main joints around the shoulders, elbows, knees, ankles, fingers, etc., are used in a spacesuit to provide

the body with mobility. The hinges may be of different designs, depending on the kind of movements in which the hinges are involved. In addition, hermetically sealed bearings are used in many joints (shoulders and hips, for example); the cut of the spacesuit is improved and lighter and more flexible materials are developed, all for the purpose of improving mobility.

While working in the first spacesuits cosmonauts had to exert considerable extra effort because of their relatively poor mobility, which eventually intensified metabolic processes in the body. Consequently it was necessary to increase oxygen supplies and, for closed systems, to use even more carbon dioxide adsorbents and larger cooling systems.

In spite of progress that has been made since that time, mobility in a spacesuit continues to be a major problem.

#### A Little History

All spacesuits are divided into three classes:

rescue suits, which are used for protecting cosmonauts in event of rupture of the cockpit or substantial deviations of the parameters of its atmosphere from normal;

suits for working in open space on the surface of or near a spaceship;

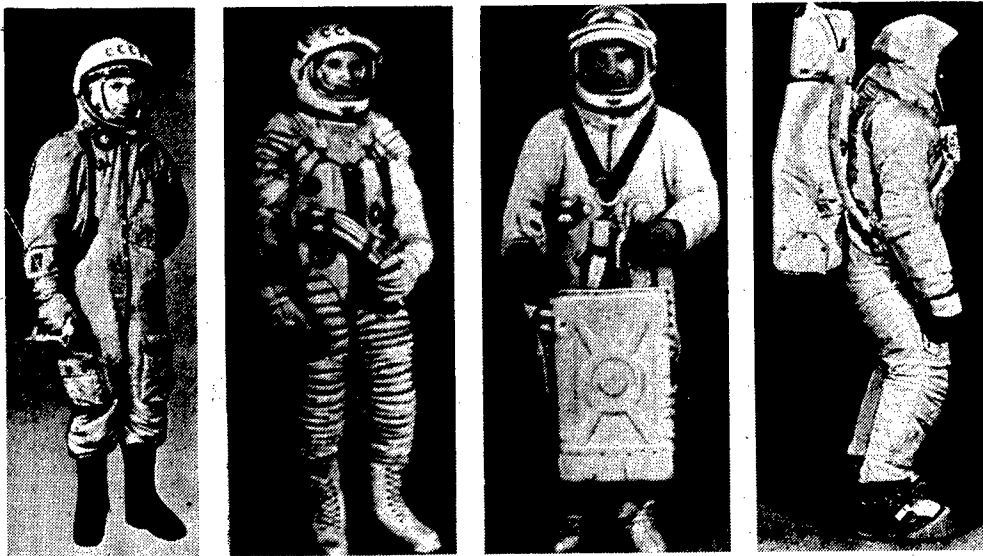
suits for working on the surface of celestial bodies.

There are also general purpose spacesuits that can be used both as rescue suits and for work in outer space.

The first spacesuits, used during "Vostok" flights, were simply multipurpose rescue suits. They could protect cosmonauts in the event of rupture of the cockpit, during catapulting in the final stage of descent and in case of possible subsequent flooding. Incidentally, attempts to make spacesuits serve multiple purposes and to adapt them to all possible flight conditions made the first spacesuits substantially complex and unwieldy. The reader will recall when Yu. A. Gagarin, preparing for his flight, first donned heavy heat-insulating clothing with a ventilation system, and only then get into the spacesuit itself. Over the spacesuit he wore various accessories for protection after landing on water, and he carried an emergency radio station in his pocket.

During flights lasting not longer than a few days cosmonauts wore their suits during the entire flight time. This imposed a number of serious additional requirements: the cosmonaut had to be able to work with all on-board equipment, eat and drink and use the body waste removal system while wearing his spacesuit. Later, during "Soyuz" flights in particular, the cosmonauts began to wear rescue suits only in especially important cases, for example during insertion in orbit, docking, re-entry from earth orbit and, of course, while working in outer space.





Spacesuits (left to right): rescue suit used during Yu. A. Gagarin's flight on "Vostok" (1961); suit worn by A. A. Leonov for work in outer space during flight of "Voskhod-2" (1965, shown without heat-insulating outer garment); suit worn by A. S. Yeliseyev and Ye. V. Khrunov for crossing outer space from "Soyuz-5" to "Soyuz-4" (1969); suit used for flight to moon in "Apollo" program (1969).

As we know, A. A. Leonov, during the flight of "Voskhod-2" in 1965, took history's first spacewalk. This even proved that man can work in outer space. Several other somewhat longer spacewalks were performed during the ensuing years by Soviet cosmonauts from "Soyuz-5" and by American astronauts from "Gemini" and "Apollo" flights and from the "Skylab" orbital station.

It is important to note that the basic operating modes of a rescue suit substantially differ from those of a suit intended for work in outer space. A rescue suit must make work inside the sealed cockpit as easy as possible, i.e., in the uninflated state, and a rescue suit is automatically pressurized only in the event of an emergency situation. A suit for working in outer space must enable a cosmonaut to work continuously under internal excess pressure. A rescue suit usually operates in combination with the on-board life support system, whereas a "walking" suit must have an independent life support system, an ASOZh as an integral part of the suit.

#### Suits for the "Soyuz"-"Salyut" Complex

It was deemed advisable to use two different types of suits for the space complex made up by ships of the "Soyuz" type and the "Salyut-6" orbital station. The lightest possible "lightweight" suit, tailor made for each individual cosmonaut, was used as a rescue suit. This was essentially a laminated hermetically sealed overall, combined with a soft helmet. The top part of the helmet with a visor could be flipped back.

The spacesuit weighed no more than 8-10 kg and the thickness of the laminated fabric was minimal so that the suit would conform with the personal contour of the shock-absorbing couches, which eased the forces of accelerations during insertion into orbit and re-entry. The main structural part of the suit was the outer pressure shell, designed to withstand the loads developed by internal excess pressure. The pressure shell was made of high-strength synthetic material and had several hinges. Cosmonauts get into this suit through a soft front fly.

Cockpit air, regenerated in the on-board life support system, is used for ventilating the rescue suit. When the cabin is depressurized the suit is inflated to the required pressure, oxygen is supplied and carbon dioxide, moisture and heat are removed by an independent on-board system.

Suits of a fundamentally new design, of the so-called semihard type, are used for going out into space from the "Salyut-6" station. Their chief distinguishing feature is a hard metallic frame, or quirass. It is combined with the helmet and life support pack as a single piece, and the sleeves and legs of the suit are soft. This suit is not put on, but is rather entered from the rear through a hatch in the quirass. The ASOZh, which simultaneously serves as the airtight cover of the entrance hatch, is fastened on the back of the suit.

This was the first semihard suit to be used in space. It offers the following indisputable advantages:

lightweight and fast donning (more accurately speedy "entry" into the suit); the suit, prepared for operation, can be gotten in and out of in literally 2-3 minutes unassisted;

ease of operation and high reliability. The suit has no external pneumatic or hydraulic lines connecting it with the ASOZh backpack; the controls are conveniently laid out on the hard frame of the suit (previously used soft suits, for example the "Apollo" suit, had a separate ASOZh backpack; this pack was worn over the spacesuit and, naturally, was connected to it by several flexible tubes and cables, which were also exposed to the severe conditions of outer space outside of the spaceship;

high seal. the entry hatch of the suit is sealed by a reliable mechanical lock;

the single-size semihard suit can be worn by cosmonauts of different sizes. By virtue of the rigid frame the increased spaces between the body and the shell do not play an important role, and the length of the elastic shells (sleeves and legs) is adjusted by each individual cosmonaut in accordance with his height; semihard suits are constantly kept aboard "Salyut-6" for work in space and may be used by anyone who goes to the station.



Yu. V. Romanenko prepares his suit for exit into outer space during flight aboard "Salyut-6" orbital station (photo by G. M. Grechko).

It is also important to point out that the semihard suit is smaller in the operating mode than the corresponding soft suit in the pressurized state with the backpack.

To ensure satisfactory mobility under excess pressure the suit is equipped with sealed bearings and soft hinges. The gloves are detachable and are tailored for each individual cosmonaut.

The independent life support system of the suit is a closed regenerating system. It consists of several functionally related systems, including:

- an oxygen supply system with systems for storing oxygen and for controlling and maintaining pressure inside the suit;

- a ventilation and gas composition control system with units for purifying the atmosphere of the suit of carbon dioxide and contaminants;

- a temperature control system;

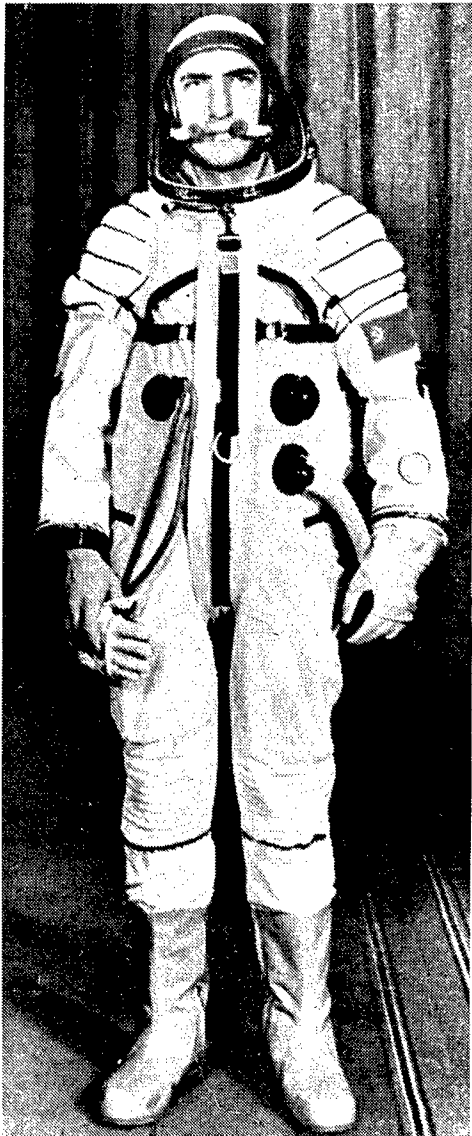
- an electrical equipment, control and systems performance monitoring system;

- a radio communications system.

The temperature control system utilizes a water-cooled cellular undergarment and cap with in-woven thin plastic tubes, through which circulates the water that is cooled in a heat exchanger. Unlike the method of removing heat from the suits of the "Voskhod-2" and "Soyuz-5" ships by means of vent gas, this technique maintains normal temperature conditions inside the suit at virtually any level of physical activity on the part of the cosmonaut and during the entire "work shift." The cooling rate is controlled by the cosmonaut himself.

The suit can be used for work in outer space many times. The water tank of the cooling system of ASOZh can be recharged, the spent carbon dioxide adsorption unit can be replaced and oxygen supply units can be recharged or replaced after each operation in outer space. The main life support systems of the suit are duplicated by backup units.

The viability of the systems and equipment of the suit under the conditions of profound cosmic vacuum is guaranteed by the choice of the proper materials and friction couples in hinges, by the use of special lubricants and by the installation of many of the systems inside the shell of the suit.



Rescue suit for flights on "Soyuz" spaceships.

plex in flying laboratories, special tanks (for simulating weightlessness conditions), in temperature and altitude chambers and in simulators.

The development of the new spacesuit and its successful performance on the "Salyut-6" orbital station represent a great step forward in spacesuit engineering.

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A so-called electrical halyard, which is a special multiple-conductor cable, connecting the systems of the spacesuit with the "Salyut-6" station, is used for supplying power to the units of the suit, for radio communications and for transmitting telemetry from the cosmonaut to earth. The pressure of the atmosphere inside the suit during work in outer space is less than that on earth, and the concentration of oxygen in the suit is higher. Therefore the suit and ASOZh were designed and, in particular, the materials were selected and the units, instruments and systems, including electrical and electronic, were designed and developed in consideration of rigid fire safety requirements.

The development of a suit for work in outer space from the "Salyut-6" station required the completion of a great volume of investigations and experimental development of the units and of the complex as a whole.

In contrast to other kinds of space technology, which is tested in the final stage during unmanned space flights, the suit was perfected with the mandatory participation of test personnel under terrestrial conditions as close as possible to natural conditions. Much attention was devoted in this connection to simulation of the operating conditions of the suit, ASOZh and materials and to the development of methods of perfecting the com-

## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### MAIN RESULTS OF THE SCIENTIFIC ACTIVITY OF THE ACADEMY OF SCIENCES OF THE LATVIAN SSR DURING 1977

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 5, 1978 pp 5-17

[Article by V. P. Samson, Academician of the Academy of the Sciences of the Latvian SSR and Chief Scientific Secretary of the Presidium of the Academy of Sciences of the Latvian SSR]

[Text] The reporting year of 1977 was an important landmark on our path toward communism. Last year the peoples of the Soviet Union together with all progressive mankind noted the 60th anniversary of the world's first socialist government. The great achievements of the workers of our country during the years of Soviet power were reinforced in legislative form in 1977 by the new constitution of the USSR, which the Supreme Soviet of the USSR adopted after public discussion.

The Presidium, Party Committee and Combined Trade-Union Committee of the Academy of Sciences of the Latvian SSR conducted extensive work on organization and implementation of measures in our collective, devoted to the 60th Anniversary of the Great October Socialist Revolution. A socialist competition for a worthy welcome of the important date was organized at all institutes and at enterprises of the academy. According to the plan of preparation for the 60th Anniversary of the Great October Socialist Revolution, ratified at the beginning of the year, two monographs "The Great October Socialist Revolution in Latvia" and "Years of Labor and Creativity" (on the history of socialist competition in Latvia) were published.

Scientists of the academy published more than 40 articles in the periodical literature on the October revolution and on its historical significance. An issue of the journal IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR, devoted to the anniversary, was published and a series of articles in other issues of the journal was published. Scientist-historians organized and held two scientific-theoretical conferences.

The solemn General Meeting of the Academy of Sciences of the Latvian SSR, devoted to the 60th Anniversary of the Great October Socialist Revolution, was held on 14 October of the reporting year. The Vice President of the Academy, Academician of the Academy of Sciences of the Latvian SSR A. A. Drizul gave a report at the meeting entitled "The Victory of the Great October Socialist Revolution in the Baltic States."

Anniversary exhibitions of scientific advances were organized at all institutions of the academy and grand meetings and expanded sessions of scientists of councils, devoted to the anniversary, were held on the topic "The Great October Socialist Revolution and the Development of Science."

Three conferences of young scientists, devoted to the 60th Anniversary of the Great October Socialist Revolution, were organized. Young scientists of Latvia, Estonia and Belorussia participated in their work.

The "Znaniye" Society of the Academy of Sciences of the Latvian SSR conducted 17 Days of Sciences and also 85 conferences and periodical sessions in the cities and rayons of the republic during preparation for the anniversary. A total of 27 lectures and 38 specialized lecture cycles was organized in the rayons of the republic and at large enterprises. Lectors of the "Znaniye" Society of the Academy of Sciences of the Latvian SSR gave approximately 4,000 lectures.

The collective of the academy participated most actively in discussion of the draft of the new constitution of the USSR. A total of 50 meetings at which 3,400 persons participated, 340 persons spoke and 57 suggestions were introduced, was held at the institutions and at enterprises of the academy. During discussion of the draft of the constitution, the problem of the need to create a legal department in one of the humanitarian institutes of the academy was raised. A Department of Problems of Improving Soviet Legislation was created at the Institute of History on the basis of a decree of the presidium. It began its activity with coordination of legal investigations in the republic and combining the efforts of the scientists of the republic to solve the most timely problems in light of the new constitution of the USSR. The department has already begun to investigate constitutional problems, specifically, problems of democracy in the new constitutions of the union republics.

Investigation of these problems is timely and necessary both with regard to adoption of the constitution of the USSR of 1977 and with regard to preparation for adoption of the constitutions of the union republics and a wide range of constitutional and other laws. The scientists of the academy are participating in development of the constitution of the Latvian SSR.

The public rise of political and labor activity, caused by preparation for the anniversary of the our government and by discussion of the new constitution of the USSR, contributed to successful fulfillment of both general academic and intrainstitute socialist pledges and to successful completion of the planned work of the reporting year. The plan of scientific research work for 1977 by scientific institutions of the academy was fulfilled for all tasks. The results of the activity of the scientific institutions were discussed at the recently held general meetings of the departments of the Academy of Sciences of the Latvian SSR.

An important event in the scientific life of the Academy of Sciences of the Latvian SSR during the reporting year was the arrival of a commission organized by the Presidium of the USSR Academy of Sciences, which included the leading

scientists of the USSR Academy of Sciences to evaluate the activity of institutions of our academy during the past decade and to render scientific-methodical assistance to refine the main directions of scientific research.

The main directions of the activity of our academy on which we have been working until now were determined in 1965 with participation of the leading scientists of the USSR Academy of Sciences. The scientific potential of the institutions of the academy has changed significantly during the past 12 years. The theoretical level of our work was raised as a result of the quantitative and qualitative growth of cadres and of great positive changes in equipping experiments and we are now able to carry out scientific research in new fields of scientific thought, previously inaccessible to us.

A serious discussion was held at the institutes of the academy and at joint meetings of the Presidium of the Academy of Sciences of the Latvian SSR and the Committee of the Presidium of the USSR Academy of Sciences on the main scientific problems on which the scientific institutions of the republic are working and on the results achieved and the existing difficulties in the work.

Based on the materials prepared by the committee, the Presidium of the USSR Academy of Sciences noted in its resolution on the result of checking the Academy of Sciences of the Latvian SSR that the main part of scientific research of our scientific institutions corresponds to the subject matter indicated in the Main Trends for Development of the National Economy of the USSR for 1976-1980, adopted by the 25th CPSU Congress. Further expansion and deepening of research on the natural and engineering sciences is planned in the following scientific directions approved by the 25th CPSU Congress: solid state physics, semiconductors and dielectrics to develop structures for data storage and processing, magnetic hydrodynamics and electrodynamics to develop new technologies, apparatus, machines and computer technology. A significant position is allocated to research on development of materials with new properties, investigations of the nature of nuclear forces to develop a precise theory of the atomic nucleus and to use the achievements of nuclear physics in related fields of science and in the national economy.

Extensive research is planned on molecular biology and research and development of physiologically active compounds by chemical and microbiological means.

Further development of research on the history of the victory of socialism in Latvia, protection of its victories and construction of a developed social order and also on the history of culture and language is provided in the field of the social sciences.

As before, much attention will be devoted to problems of increasing the efficiency of social production.

The Presidium of the USSR Academy of Sciences noted that the Academy of Sciences of the Latvian SSR occupies a leading position in the country in such scientific trends as magnetic hydrodynamics, the mechanics of solids

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and polymers, the chemistry of wood and its components, plasmochemical synthesis, refractory compounds, computer complexing, automation of experiment and systematic research in power engineering.

The Commission of the USSR Academy of Sciences gave positive marks to many theoretical investigations of our institutes, which was also noted in the decree of the Presidium of the USSR Academy of Sciences.

The Institute of Physics, jointly with scientists of the GDR, are successfully solving problems in the field of magnetic hydrodynamics on substantiation of the magnetohydrodynamic origin of the earth's magnetic field and other heavenly bodies. The principles established in this case made it possible to evaluate the possibility of the appearance of a very important effect in powerful fast-neutron atomic power plants and thermonuclear installations -- spontaneous formation of a magnetic field in cooling molten metal fluxes. A number of organizations of the country, together with scientists of our academy, are now involved in study of the possibility of using the results of this research.

The Physics and Power Engineering Institute has carried out a complex of physical investigations of semiconducting structures in the semiconductor-dielectric film system, which is the basis for modern semiconductor instrument building. Fundamental results on the energy structure of organic semi-conductors have been obtained.

The physical theory of the breakdown of polymer materials and composites with a polymer matrix achieved further development and the scientific bases of multiparameter diagnosis and prognosis of the stiffness and strength of polymer materials and structures were developed at the Institute of the Mechanics of Polymers in the field of the theory of deformation and breakdown of solids and polymers.

Astronomers of the academy discovered a number of new carbonaceous stars. The transient nature of carbonaceous stars in two directions of the Milky Way was studied. The data make it possible to improve classification of variable carbonaceous stars.

The interaction of condensed particles with plasma streams and the kinetics and mechanisms of chemical reactions in a low-temperature plasma were studied at the Institute of Inorganic Chemistry on the plasmochemistry of inorganic compounds. Plasma technology for producing a number of compounds and materials with the given physical-technical characteristics was developed.

Investigation on the search for compounds having antitumoral and antiviral activity achieved extensive development at the Institute of Organic Synthesis. Investigations in the field of bioorganic chemistry and molecular biology, which led to the determination of new principles of functioning of the regulatory mechanisms of the cell, have advanced to the forefront during the past few years.



Data on the nature of interfiber bonds and their modification in cellulose materials were obtained in the field of the chemistry of wood and its main components.

The Institute of Biology worked out an essentially new approach to optimization of mineral nourishment of plants, which takes into account the entire complex of macrocells and trace elements and their availability to the plant. Investigations within the framework of the republic complex program were developed intensively in the field of environmental protection and the basis for creation of a Red Book of the Latvian SSR was established.

Investigations of the mechanism of virus and cell interaction are being conducted successfully to determine the role of viruses in tumor growth at the Institute of Microbiology imeni Avgust Kirkhenshteyn.

The Botanical Garden has completed a dendrological landscape inventory of old parks, gardens and foreign collections of decorative trees and shrubs of Latvia. The presently existing list of state-protected dendrological objects has been critically revised on this basis.

The Institute of Economics, jointly with other scientific organizations, has worked out a scheme for development and disposition of the productive forces of the republic up until 1980 and the main concepts to the year 2000. The method of planning socioeconomic development of collectives has been improved at different levels: enterprises, ministries and administrative rayons; the actual and future time balance of the population of the union republic has been established. The methodical bases for creation and functioning of agrarian-industrial associations has been developed.

A number of important monograph investigations on the history of the Great October Socialist Revolution in Latvia, on the red Latvian arrows and on the struggle of the Latvian people during World War II has been published in the field of the social sciences in development and deepening of separate sections of the three-volume history of the Latvian SSR, completed in the 1960's. Writing a three-volume history of the city of Riga has been completed.

The two-volume "History of Latvian Literature" (in Russian), which is a theoretically thorough version of the six-volume history of Latvian literature previously published in Latvian, has been published. The first three volumes of an eight-volume dictionary of the modern literary language of Latvia have been published. Preparation of the scientific edition of a collection of the works of the national poet Yan Raynis (in 30 volumes) is proceeding successfully. Work is continuing on a fundamental edition of Latvian national songs. Investigations are being conducted on the history of the theater, the history of the fine arts of Latvia and on other types of art important for development of a national culture.

According to established tradition, the Presidium regularly hears scientific reports at its meetings on the most interesting and significant research of

theoretical and applied significance. It should be noted that the results of serious theoretical investigations usually contain valuable practical recommendations.

The scientific report of Doctor of Chemical Sciences E. Ya. Gren was heard with great interest at the session of the Presidium of the Academy.

Regulation of biosynthetic processes at the gene level is of primary significance in such a complex self-controlled system as is each living cell. Therefore, problems of regulating matrix biosynthesis, i.e., biosynthesis of nucleic acids and proteins, occupy one of the leading positions in modern molecular biology and molecular genetics. Uncovering the molecular mechanisms of the processes occurring during functioning of the genetic apparatus of the cell is of important theoretical significance. At the same time acquiring the required knowledge on regulation of gene activity and methods of gene modification may create essentially new approaches to direct interference in the vital processes of the cell and organism.

Investigations of the structure and function of sections of matrix RNA designed for regulatory purposes are being conducted at the Laboratory of the Chemistry of Nucleic Acids of the Institute of Organic Synthesis of the Academy of Sciences of the Latvian SSR. These investigations led to the discovery of a number of important principles of recording regulatory information in matrix RNA, which codes the origin of genes. It was clearly shown for the first time that the regulatory signal for initiation of protein synthesis and also for control of it is coded on a comparatively short section at the beginning of the gene, which can also function in short fragments split off from the matrix RNA. The established fact of separation of structural and regulatory information in matrix RNA is of important significance since the possibility of artificial design of a gene with given activity by connecting it to the structural part of the desired regulatory section has been confirmed for the first time.

It was especially emphasized in the resolution adopted by the Presidium of the Academy that the investigations headed by E. Ya. Gren are being conducted at a high modern level which will be achieved due to the presence of a collective of erudite scientists and the modern equipment and reagents necessary for molecular-biological investigations.

In his scientific report, Corresponding Member of the Academy of Sciences of the Latvian SSR M. Ye. Beker talked about the use of microbiological processes to increase the food protein resources and about investigations organized at the Institute of Microbiology on production of microbial protein by transformation of photosynthesis products. The Institutes of the Chemistry of Wood and Biology, the institutes of the Ministry of Agriculture of the Latvian SSR, VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], the Academy of Sciences of the Belorussian SSR and the Kolkhoz "Uzvara" of Bauskiy Rayon, where a base laboratory and experimental installation is being organized with participation of the Institute of Microbiology and where it is planned to create an experimental biological shop during the 10th Five-Year Plan, are participating in these investigations.

The Presidium of the Academy approved with satisfaction the communication of Doctor of Technical Sciences I. G. Matis on investigations conducted at the Institute of the Mechanics of Polymers on development of methods and means of nondestructive testing of the quality of domestic articles of structural polymer materials based on the use of electrocapacitive transducers.

Investigations in the field of stochastic conversion of information, directed toward development of new effective methods and electronic means for coding analog signals of different physical nature, are being carried out successfully at the Institute of Electronics and Computer Technology under the supervision of Candidate of Technical Sciences I. Ya. Bilinskiy. As I. Ya. Bilinskiy reported to the Presidium, the investigations made it possible to develop a number of original data converters corresponding to the world standard.

The investigations which Doctor of Technical Sciences E. Ya. Blum reported to the Presidium merit attention. A broad complex of theoretical and experimental investigations in the field of the thermophysics of liquid magnetized media is being carried out under his supervision at the Institute of Physics and many of the studied phenomena have practical significance. Specifically, proposals have been prepared on development of thermomagnetic cooling systems with respect to the conditions of weightlessness and the jacket of thermonuclear reactors. The ferrohydrodynamic method of direct conversion of thermal to electric energy, the use of FHD processes to control the course of separation in the mining industry, in machine building and so on merits attention. Interesting possibilities are being opened for use of magnetic liquids in medicine -- for creation of an artificial heart, treatment of arterial aneurysms, localization of medicines during cancer chemotherapy and also for purposes of medical diagnosis.

The General Secretary of the Central Committee of the CPSU comrade L. I. Brezhnev said in a meeting with the heads of the academies of sciences: "We feel it is necessary, by extensively stimulating the development of fundamental sciences, to be concerned about the organic joining of applied research to them and to accelerate introduction of scientific discoveries into the national economy."\*

The new forms of contact of science and industry, developed by the Academy of Sciences of the Latvian SSR, were approved by the Presidium of the USSR Academy of Sciences. These forms of cooperation of scientists and practitioners were already discussed at the last annual general meeting of our academy, both in the official report of the Presidium and in a number of speeches of members of the academy.

The constant concern of our scientific institutions about improving the form of contact of science and industry has yielded discernible results during the past few years. A significant part of the theoretical and fundamental research laid the basis for development of applied

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\*KOMMUNIST, No. 4, 1977, p. 9.

investigations which contribute to solution of timely problems of the national economy. The special importance of development of new production processes, machines, apparatus and materials which provide a significant increase of labor productivity and product quality, was taken into account by the institutes in this case.

The Presidium of the USSR Academy of Sciences is allocating an important role in the matter of acceleration of scientific and technical progress to the academic scientific-technical complexes. These complexes facilitate to a significant degree the process of introducing the developments of the academy into the national economy. The main task of the experimental-industrial subdivisions of the complex is to produce experimental models of the devices, equipment and preparations developed at the institute and to develop the technology of their production.

The scientific and technical complexes of the Institute of Organic Synthesis with the Experimental Plant and Riga Plant of Medicinal Preparations, the Institute of Physics with the SKB [Special Design Office] of Magnetic Hydrodynamics, of the Institute of the Mechanics of Polymers with the SKB of Scientific Instrument Building and the Experimental Plant, the Physics and Power Engineering Institute with the Experimental Electromechanical Plant and the Institute of Microbiology imeni Avgust Kirkhenshteyn with the Experimental Plant of Biochemical Preparations should be recognized as productive and promising.

The presence of their own experimental enterprises and special design offices permits the scientists of the academy to propose apparatus, machinery, materials, preparations and production processes which have already undergone a serious check to the national economy for serial production.

The scientific and technical complex headed by the Institute of Organic Synthesis has created many valuable medical preparations and physiologically active compounds. A total of 54 preparations, including fluorofur -- a substance for cancer chemotherapy which has achieved wide recognition not only in our country but abroad as well, has been put into production. Synthesis of this preparation was developed in the laboratories of the institute, while the production technology was developed by the experimental plant.

The results of the fundamental research of the Institute of Organic Synthesis significantly affected the development of the chemical and chemical-pharmaceutical industry of the Latvian SSR. In 1975-1977 the volume of production of preparations created by the institute comprised an average of 35-40 percent at a number of chemical plants of the republic among the total volume of consumer goods production.

A series of electromagnetic pumps for pumping and proportioning molten metals and electrolytes was created by the SKB of Magnetic Hydrodynamics on the basis of the fundamental research of the Institute of Physics. A series of

automatons, capable of moving, orientation, installation and rejection of small parts by using magnetic and electric fields, was also created. These automatons are being used extensively in the clock and electronics industries at plants at Riga, Sverdlovsk, Tol'yatti, Vil'nyus, Dnepropetrovsk and so on.

The theoretical research of the Institute of the Mechanics of Polymers was the basis of devices and sensors, developed by the SKB of Scientific Instrument Building, for measurement and gathering of data on the chemical, physical and mechanical properties of materials and structures. The developments of the scientific-technical complex of the Institute of the Mechanics of Polymers have found application in organizations of the all-union ministries and at enterprises of the Latvian SSR.

The Institute of Electronics and Computer Technology, which has a SKB and experimental sections, has done a lot to develop the theory of finite automatons and applications of it.

Practical application of the methods developed by the institute makes it possible to increase the efficiency of logical planning and monitoring of a wide range of logic devices for processing digital data.

The scientists of the Institute of Microbiology imeni Avgust Kirkhenshteyn, who developed the technology for lysine production -- the most important of the unsaturated amino acids for living organisms -- at their own experimental plant, made an important contribution to development of the microbiological and mixed feed industry. Industrial production of a liquid food concentrate of lysine has been organized at the Livany Plant (Latvian SSR) and a plant of the Armenian SSR and five additional plants are being constructed, which will make it possible to reduce the shortage of protein feeds in animal husbandry to a significant degree.

Our microbiologists have developed a technique for producing other amino acids, enzymes and catalysts; their production is already being organized at the Livany Plant.

A manual on the use of rust modifiers in the national economy has been developed on the basis of the theoretical research of the Institute of Inorganic Chemistry on the Interaction of the Surface of Metal and Agressive Media. The preparations developed by chemists of the academy are being produced by the enterprises of the republic. Their use will make it possible to avoid the heavy manual labor on cleaning structures of rust and, therefore, will produce a high economic effect.

The results of investigations of the Institute of the Chemistry of Wood in the field of chemical plasticization of low-value wood are of important national economic significance. The technology recommended by the institute makes it possible to produce valuable "Lignamon" material, which can be used extensively in the woodworking and furniture industry.

By 7 October of last year, the institutes of the academy had completed 15 scientific-technical developments for the national economy which were included in the general academic pledges.

The Institute of Physics has developed and introduced a method of input control of silicon of high purity at one of the Riga enterprises, which permitted an increase in the percent yield of suitable articles and to achieve a significant economic effect due to their high cost.

The Physics and Power Engineering Institute and its Electromechanic Plant fulfilled the pledge ahead of schedule to manufacture, adjust and turn over to the SKB of Vacuum Coatings Attached to Gosplan of the Latvian SSR an experimental industrial model of the VIMP-1 device. According to the official report of introduction, the economic effect from using this device comprised 9,100 rubles annually per model.

The Institute of Electronics and Computer Technology has prepared and turned over to the Measuring Instruments Plant the PI-50-1 high-speed pulsed potentiostat and the PR-8 programmer for serial production of a potentiostat complex. It is assumed that the economic effect due to use of the potentiostat in combination with the programmer will comprise 813,600 rubles annually.

Based on the socialist pledges, the Institute of the Mechanics of Polymers, jointly with the Kalntsiyems Construction Materials Combine, has designed and manufactured a mockup of a plant installation and have worked out the main parameters of the process of producing light-transparent roll glass-fiber-reinforced plastic using a new technique of ion-exchange modification of fiberglass.

The Institute of Inorganic Chemistry has created a new group of highly effective organic reagents for extraction of alkali-earth metals by inert organic solvents.

The Institute of Organic Synthesis, based on general academic pledges, has organized and is successfully conducting production tests of diludine preparation as a growth stimulant for agricultural animals. It was also determined that the preparation increases milk yields by 14 percent with a simultaneous increase of its fat content by 0.2-0.3 percent, and the vitamin A content by 50 percent. Work on the diludine preparation was noted by the State Prize of the Latvian SSR in 1977.

The Experimental Plant of the Institute of Organic Synthesis has organized production of pentagastrin -- a preparation for diagnosis of the functional state of the stomach and dimethylmorphomenic hydrochloride, which is undergoing successful tests in cotton raising. Its use will increase the yield of cotton by 15-20 percent while reducing the maturation time by 45 days.

The Institute of the Chemistry of Wood has completed development of a production technique and is conducting experimental-industrial production of rigid foam polyurethane.

The Institute of Microbiology imeni Avgust Kirkhenshteyn has prepared a specific diagnostic antiserum to determine leucosis in horned cattle.

The annual economic effect from using the serum will comprise 623,000 rubles.

According to adopted pledges, the Institute of Economics has prepared manuscripts of two timely works: "Method of Development and Use of the Consolidated Production-Financial Model of the Union Republic and "Optimization of the Disposition of Agricultural Production and of State Purchases (Methodical Problems)."

Agreements on scientific and technical cooperation, concluded by the institutes of the academy with enterprises and organizations of different branches of the national economy, have been widely distributed in the academy.

Work on 272 agreements on scientific and technical cooperation has been carried out during the reporting year.

The collective of the Academy of Sciences of the Latvian SSR pledged at the beginning of the reporting year to fulfill the plan of scientific and technical developments on agreements with enterprises and institutions worth a total of 4,214,000 rubles by 25 December (384,000 rubles more than in 1976). The pledges were fulfilled successfully. The number of agreements concluded for the long-term continues to grow. Long-term agreements on scientific and technical cooperation have been concluded by the Institute of Physics, Physics and Power Engineering Institute, the Institute of the Mechanics of Polymers and the Institute of Microbiology imeni Avgust Kirkhenshteyn.

Economic agreements (sometimes multiple) to turn over specific developments are being concluded during fulfillment of the long-term agreement on scientific and technical cooperation.

The laboratories whose work is being financed by the branch ministries play a significant role in strengthening the ties of science and industry. Four branch laboratories with a wage fund of 94,200 rubles are now operating at the institutes of the academy.

Complex brigades, groups and creative teams which include research associates of the scientific research institutes and workers of interested enterprises and organizations, are being created at a number of institutes of the academy (Physics, the Mechanics of Polymers, the Chemistry of Wood and so on) to conduct specific work on introduction of completed scientific research. Thus, a complex brigade jointly with the p/o [Production Association] "Al'fa," has been created at the Institute of Physics to introduce techniques of transistor production. The technology was assimilated within short deadlines and made it possible to essentially eliminate rejection according to the dynamic parameters of the devices produced.

A creative team for assisting in operative and quality development of technical-economic justification for construction of a yeast plant has been created

from specialists of the Institute of the Chemistry of Wood and the Ministry of Agriculture of the Latvian SSR.

An overall trend of strengthening economic agreements is noted. However, some institutes are still fulfilling small economic agreements, which leads to dispersion of forces and to reduction of the effectiveness of scientific research. Small agreements are concluded mainly with republic organizations of the Ministry of Agriculture, the Ministry of Forest Management and the Lumber Industry and the Ministry of the Woodworking Industry.

Conclusion of economic agreements on turnover of scientific-technical documentation to different planning organizations and enterprises has been practiced extensively of late. Turnover of technical documentation for instruments, devices and techniques is practiced most extensively. Thus, the Institute of Inorganic Chemistry turned over the technological instructions of the process of electrolytic coating of tin from the complex potassium pyrophosphate electrolyte to 101 enterprises and the technique of electrolytic precipitation of copper on a base of steel and zinc alloys to 63 enterprises.

The effectiveness of the invention and patent-licensing work of a number of our institutes and of the academy as a whole was especially noted by the Presidium of the USSR Academy of Sciences.

A total of 730 author's certificates and 240 foreign patents was obtained by institutions of the Academy of Sciences during the period 1971-1975. Considerable work has been carried out on commercial and advertising study of patented inventions to sell them on the foreign market in the form of licensed agreements and export production. Seven licensing agreements with organizations of countries of socialist cooperation and companies of the capitalist countries were concluded during the Ninth Five-Year Plan. The institutes of the academy have concluded six new agreements with foreign companies during the first 2 years of the new five-year plan, including an agreement with the CSSR for production of citric acid, one with Yugoslavia for a method of furfural production, one with the GDR for magnetohydrodynamic pumps and one with the United States for fluorofur preparation.

It should be noted that the sale of licenses and the presence of currency influxes made it possible for sum of our institutes to significantly modernize their experimental base and to acquire the necessary imported equipment.

The Presidium of the USSR Academy of Sciences commissioned its own Patent Department jointly with the Council on Coordination of the Scientific Activity of the Academies of Sciences of the Union Republics to hold an interrepublic meeting at Riga on problems of utilizing the experience of the patent-licensing activity of the Academy of Sciences of the Latvian SSR. This meeting was held in the middle of February of this year with the participation of the vice presidents of the academies of sciences of the union republics. We hope that it will be useful to its participants.



The Presidium of the USSR Academy of Sciences recommended that coordination of scientific research work be intensified in the republic, that it be reflected more fully in future and annual plans of the work of the branch institutes and higher educational institutions and this proposition, in view of specific legislation, was primarily addressed to the scientific organizations of biological profile.

The need to turn special attention to coordination of joint research on ethnogenesis of the Latvian people, problems of the history of Soviet society and problems of demography and sociolinguistics was pointed out in the field of the social sciences.

Quite specific positive changes in training of scientific workers of higher qualifications were noted during the past decade in the academy, which made it possible for our scientific research institutes to form 11 specialized councils on awarding of scientific degrees, of which 5 councils have the right of acceptance for defense of doctoral dissertations in 8 specialties. Taking into account the very strict conditions set up by VAK [High Degree Commission], in the given case we can talk both about successful organizing work on creation of specialized councils and on the presence of the scientific cadres required for their formation.

Having recognized that the stage of training the leading scientific cadres that we went through as satisfactory, the Presidium of the USSR Academy of Sciences at the same time feels that one of the serious problems of the Academy of Sciences of the Latvian SSR is future training of highly qualified specialists (doctors of sciences), especially in scarce specialties, and recommends that the probationary period of scientists at the institutes of the USSR Academy of Sciences be used more extensively for these purposes.

The Commission of the USSR Academy of Sciences, having become thoroughly familiar with the material-technical base of the Academy of Sciences of the Latvian SSR and having taken 1965 as the initial position, feels that changes in the status of the laboratories and the experimental-industrial base and of the housing-service conditions of workers of the academy are very significant. A total of 12 laboratory buildings with a total area of approximately 300,000 square meters and approximately 20 different types of experimental bases and buildings for auxiliary services (workshops, vivaria, greenhouses and similar structures) was constructed during these years and two plants (the Experimental Plant of Biochemical Preparations and the Riga Plant of Medical Preparations) were turned over to the academy. Eight apartment buildings with a total complexity of 285 apartments were constructed, 283 apartments were partially constructed; moreover, the research associates of the academy received 269 cooperative apartments and 2 dormitories, a kindergarten day-care center and a pension for the recreation of scientists were constructed.

However, the accelerated rates of scientific and technical progress and the increasing role of science in the development of productive forces do not permit us to rest on our laurels.

The Presidium of the USSR Academy of Sciences decided to request the directive organizations of the republic to render assistance to the Academy of Sciences to strengthen and expand the experimental and material-technical base, to equip the scientific institutions with modern measuring apparatus, computer and cryogenic technology, to improve the supply of scientific equipment, materials and transport and also to expand the housing construction.

The General Secretary of the Central Committee of the CPSU, Chairman of the Presidium of the Supreme Soviet of the USSR comrade L. I. Brezhnev, in his speech upon his being presented with the highest award of the USSR Academy of Sciences in the field of the social sciences -- the Gold Medal imeni Karl Marx -- especially emphasized the idea that the activity of scientists acquires ever greater significance with each year to the life of all the people and for development of our society.

It is natural that problems of increasing the efficiency of scientific research should now occupy and are occupying the main position in the activity of the Academy. One of the most fruitful methods of reducing time expenditures for experimental work and processing the data obtained is automation of scientific investigations.

The success of our institutes in automation of experimental work and expansion of the sphere of computer use received positive marks from the Commission of the Presidium of the USSR Academy of Sciences. A meeting on the prospects for development of computer networks and time-sharing systems in the academies of sciences of the union republics and at the centers of the USSR Academy of Sciences will be convened in April of this at year at Riga at our academy at the level of the vice presidents of the academies of sciences of the union republics. We must share our experience in automation of research.

Investigations on development of a time-sharing computer system were continued during the reporting year under the supervision of the Institute of Electronics and Computer Technology. Methods of computer complexing which provide integration of territorially dispersed computers were developed to create a three-level automated data processing system for scientific research. A consignment of integration devices which provide high-speed communications of any model of the YeS computer with four other computers separated by a distance up to 2 km was developed, manufactured and put into experimental operation. An adapter which provides integration with the computer of the Hewlett-Packard Company was developed and manufactured. The technical mission for a packet of applied programs to support communications of mini-computers with the computer system of the Academy of Sciences of the Latvian SSR over telephone channels was worked out.

Investigations on hardware and software for automation of experiments in conducting local probe measurements of semiconductor structures were carried out by means of computers at the Physics and Power Engineering Institute, which made it possible to significantly accelerate the process of research and processing of experimental results.

A packet of automated data gathering for nondestructive testing of dielectric characteristics was developed at the Institute of the Mechanics of Polymers; a Weissenberg rheogoniometer was connected to the experiment automation system, which permits a sharp increase of the number of experiments and increases the accuracy of calculating them. The installation for automation of static short-term tests of core specimens made of composites with output of the experiment on punch tape for subsequent computer processing was modernized. The noted measures made it possible to increase the labor productivity of the research associates and to successfully fulfill the increased volume of scientific research without increasing the number of workers of the institute.

The M-400 computer for automated data processing on high-temperature plasma diagnostics was put into operation at the Institute of Inorganic Chemistry.

The system for automation of scientific research, which now processes the data of physical and chemical experiments, developed at the Institute of Organic Synthesis, is contributing to a significant increase of the labor productivity of researchers. Processing of infrared spectra was automated. One hour's processing of data on a computer releases approximately 3 days of labor of a laboratory worker. Processing of low-resolution mass spectra was also automated. At the same time the investigators were relieved of the prolonged, tedious and uncreative work on deciphering the spectra.

Investigations are being carried out on machine forecasting of the biological activity of chemical compounds. Introduction of this system will permit a reduction of labor expenditures on synthesis and screening of potential medicinal and other preparations no less than a factor of 2.

An original method of precise quantitative consideration of the degree of affliction of plants with leaf diseases was developed at the Institute of Biology by using the television image structure analyzer (TASI). At the same time this method permits automation of statistical processing of experimental data.

A number of new programs and modifications of standard programs for the "VANG" computer, designed to process the results of ornithological investigations of the population ecology and migrations, was also developed.

Investigations on digital output of information measured by using the television analyzer and on development of an apparatus complex for obtaining quantitative information used for analysis of the morphological structure of plants were completed at the Botanical Garden. The television analyzer was joined to a microscope and other optical devices, which expands the range of application of the analyzer in scientific experiments.

An YeS 10-10 computer was installed in the Vysotnoye building of the academy for the needs of institutes of humanitarian profile and apparatus of the Presidium.

Everything that we have achieved is success, but any success is relative and much remains for us to do.

Along with work in the field of automation of scientific research, the institutions of the Academy of Sciences also implemented organizing measures directed toward more efficient use of the working time of the scientific research associates and their creative potential.

The Presidium of the Academy feels that one of the sources for improving the efficiency of scientific work is to raise the level of management work and to improve it.

The scientific organizing activity of the organizations which manage and service science, beginning with the central apparatus of the Presidium of the Academy and ending with the administrative subdivisions of the institutes, plays a significant role in increasing the labor productivity of scientists.

Based on the instructions of the Council of Ministers of the Latvian SSR, the Presidium of the Academy has already heard reports at its meetings of the heads of a number of institutes on these problems. It is planned to prepare an overall evaluation of the status of the management work in our institutions in April and to summarize the search for new forms of increasing the productivity of management work. In the given case, as directly in scientific research, we will be talking about automation of some types of work (in the field of information, equipping and supply of experiments, bookkeeping and so on).

It should be emphasized that search for the new should be accompanied by critical analysis of traditional and in some cases of conservative forms of work. It must be confessed that not all our meetings are conducted with the maximum saving of time and with specific positive results. The forms of applications and recordkeeping could be simplified and reduced and the work of the housekeeping services could be better organized.

The work of a scientist is a creative process and everything possible should be done to provide the optimum conditions for expanding all the capabilities of young scientific workers and for complete utilization of the knowledge and experience of leading scientists. The guarantee of our forward motion and the guarantee of completing the tasks posed by the party and government to Soviet science are in this.

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## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### ANNUAL GENERAL MEETING OF THE ACADEMY OF SCIENCES OF THE LATVIAN SSR

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 5, 1978 pp 3-4

[Text] The annual conference of the General Meeting of the Academy of Sciences of the Latvian SSR was held on 16 March 1978.

Besides active members and corresponding members of the Academy of Sciences of the Latvian SSR, the directors of institutes and their deputies, heads of laboratories and sections, scientific research associates, representatives of party and trade-union organizations of scientific institutions and enterprises of the academy and also representatives of branch scientific institutions and VUZ's of the republic participated in its work.

The First Secretary of the Central Committee of the Communist Party of Latvia A. E. Voss, the Chairman of the Presidium of the Supreme Soviet of the Latvian SSR P. Ya. Strautmanis, the Chairman of the Council of Ministers of the Latvian SSR Yu. Ya. Ruben, the Secretary of the Central Committee of the Communist Party of Latvia I. A. Anderson, the Deputy Chairman of the Council of Ministers of the Latvian SSR V. M. Krumin', the Deputy Chairman of the Council of Ministers of the Latvian SSR and Chairman of Gosplan of the Republic M. L. Raman, the First Secretary of the Riga Gorkom of the Communist Party of Latvia Ya. Ya. Vagris and others were present at the meeting.

President, Academician A. K. Malmeyster opened the annual general meeting. In his opening remarks, Academician A. K. Malmeyster said that in summarizing the results for the year, we should primarily determine to what extent our work has contributed to solution of the main task outlined by the 24th and 25th CPSU Congresses -- to provide significant growth of the standard of living of the Soviet people within short periods.

Everyone understands that only under peaceful conditions can we talk about the growth of the standard of living of the people and we are deeply grateful to the Central Committee of the CPSU and personally to General Secretary of the CPSU Central Committee, Chairman of the Presidium of the Supreme Soviet of the USSR, Comrade L. I. Brezhnev for his tireless concern about easing international tensions and strengthening the defense capability of our country.

The growth of the standard of living of the people is a direct function of labor productivity. Production efficiency during the scientific-technical revolution is determined to a significant degree by the advances of science and how quickly they are put into practice.

The words that there is nothing more practical than a good theory belong to L. I. Brezhnev. Primary importance was always given to fundamental research in the academic world. But in our view, said A. K. Malmeyster, poor is the scientist who is not concerned about how his ideas find practical application and serve the people. And in this regard the role of the branch institutes and planning organizations which directly provide integration of science and industry should be especially emphasized. The revolution in science and technology requires fundamental changes in the system, style and methods of economic activity, a decisive struggle with sluggishness and routine and it is impossible without true respect for science, know-how and the desire to consult it and take it into account.

The president of the academy told about the new forms of contact by the academy with industry and about new methods of planning scientific research which provide an entire complex of work -- from development of theoretical ideas to adoption of the academy's proposals on an industrial scale. The presence of its own experimental enterprises and planning-design offices in the academy contributes to a significant degree, states the president, to this postulation of scientific problems.

Academician A. K. Malmeyster devoted the concluding part of his speech to the work of the Commission of the USSR Academy of Sciences, which visited the Academy of Sciences of the Latvian SSR during the reporting year to become familiar with the status of scientific research at our institute to determine the main trends for development of the academy for the future.

In September of the reporting year, said A. K. Malmeyster, his report was heard at a meeting of the Presidium of the USSR Academy of Sciences, the results of the Commission's work were summarized and the activity of the Academy of Sciences of the Latvian SSR was evaluated. It is noted in the adopted decree that the level of scientific research has increased significantly during the past 10 years, the research topics of our academy correspond to the scientific directions approved by the 25th CPSU Congress and the Academy of Sciences of the Latvian SSR occupies the leading position in a number of directions.

The role of science in the life of the people is increasing with each year obligates scientists to many things. "And I am confident," said the President of the Academy A. K. Malmeyster, "that the scientists of the republic will honorably justify the trust of the people."

According to the statute on the competition for prizes in honor of outstanding scientists of the Latvian SSR, a diploma on conferring the prize in honor of Andrey Upit to Doctor of Philological Sciences V. A. Valeynis was awarded at the annual general meeting.

Based on the competition, diplomas on conferment of the first prize of the Presidium of the Academy of Sciences of the Latvian SSR were awarded to a large group of scientists of the academy.

The Chief Scientific Secretary of the Presidium of the Academy of Sciences of the Latvian SSR, Academician of the Academy of Sciences of the Latvian SSR V. P. Samson gave a report about the main results of the scientific activity of the Academy of Sciences of the Latvian SSR during 1977.

Academician A. F. Krogeris and corresponding members of the Academy of Sciences of the Latvian SSR Ya. Ya. Liielpeter, A. F. Dlyuger and A. K. Biron participated in discussing the results of the year.

The General Meeting of the Academy of Sciences heard scientific reports of Corresponding Member of the Academy of Sciences of the Latvian SSR M. Ye. Beker and Doctor of Physico-Mathematical Sciences P. T. Prokof'yev.

Elections for announced vacancies of new members of the academy were held at the end of the meeting. The following were elected as active members of the Academy of Sciences of the Latvian SSR (academicians): M. Ye. Beker in the specialty "engineering microbiology," A. F. Blyuger in the specialty "medicine," A. P. Grigulis in the specialty "Latvian literature," E. Yu. Gudrinietse in the specialty "chemistry" and V. A. Shteynberg in the specialty "philosophy."

The following were elected corresponding members of the Academy of Sciences of the Latvian SSR: I. K. Apine in the specialty "history of the CPSU," A. Ya. Blinkena in the specialty "Latvian language," A. A. Kalnyn' in the specialty "agricultural economics," R. Ya. Karklin' in the specialty "engineering microbiology," M. Yu. Lidak in the specialty "chemistry of natural substances" and P. T. Prokof'yev in the specialty "nuclear spectroscopy."

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## SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

### DISCUSSION OF THE RESULTS OF WORK OF THE ACADEMY OF SCIENCES OF THE LATVIAN SSR DURING 1977

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 5, 1978 pp 18-22

[Article by L. Sosnova]

[Text] Academician A. F. Krogeris devoted his speech to a very important problem -- popularization of scientific knowledge. He emphasized the enormous political significance of propaganda work and the responsibility of the lecturer to the audience.

A poor lecture of a research associate of the academy is not only a useless waste of time of the lecturer and of his listeners, but it also casts a shadow on the lecture work of the academy as a whole. One must take into account that the level of the audience increases from day to day. The population has access to extensive information and the lecturer, in order to interest the audience, must have improved lecturing skills and have at his disposal fresh, original data.

In rendering proper due to lecturing propaganda, A. F. Krogeris as the chairman of the Exhibition Council of the Academy devoted main attention to the problem of the most complete and expressive reflection of the scientific advances of the institutes of the academy at various types of exhibits and primarily at the exhibit of the achievements of the national economy of the Latvian SSR.

Academician A. F. Krogeris reported to the general meeting that the Academy of Sciences of the republic participated in 23 different exhibits in 1973, including 4 international and 15 all-union, and during the reporting year of 1977 it participated in 32 exhibits, including 9 international and 18 all-union.

A. F. Krogeris noted that the Institute of Organic Synthesis, Institute of the Mechanics of Polymers and the Botanical Garden participate most actively in exhibits. The Institute of Electronics and Computer Technology and the Institute of the Chemistry of Wood sometimes present their exhibits in a very interesting, successful formulation. But some institutes persistently decline to participate in exhibits and do not want to burden themselves with what they feel are superfluous concerns.



A special hall has been allocated to the Academy of Sciences at the VDNKh [Exhibit of Achievements of the National Economy] of the Latvian SSR, but we still are not always able to attract the attention of the exhibit visitors to our exhibits. The exhibition stands of the academy require especially well-thought out formulation and selectivity in presentation of the material. A serious subject should be clearly and accessibly outlined, revealing the meaning and content of the exhibit; the formulation should be attractive and should please the eye. Exhibition affairs require attention constantly rather than from case to case and they are an integral part of our work in the field of popularization and introduction of the advances of science into practice.

Corresponding Member of the Academy of Sciences of the Latvian SSR Ya. Ya. Liyelpeter devoted his speech to the patent-licensing activity of the academy and he emphasized that the Commission of Scientists of the USSR Academy of Sciences gave high marks to the patent-licensing work of the institutes of our republic academy of sciences. The institutes of the Department of Chemical and Biological Sciences and primarily the Order of the Red Banner of Labor Institute of Organic Synthesis achieved the greatest success in licensing work. The role of a pioneer in our licensing affairs belongs to it. The Physics and Power Engineering Institute achieved good results.

The plan of currency income from sale of licenses during 1977 was fulfilled by 292 percent by the academy. It is pleasant to note, said Ya. Ya. Liyelpeter, that all the currency income from sale of licenses in our republic have recently been due only to the work performed by the Academy of Sciences. But this does not give us the right to be complacent, since we have large reserves for further development of licensing work. Ya. Ya. Liyelpeter requests that we take into account in this case that it is not always feasible to sell a license for preparations, machines and technology developed by us. It is sometimes more advantageous to export the product directly. True, only those institutes which possess a sufficiently large experimental-industrial base have this capability.

In conclusion Ya. Ya. Liyelpeter said that it is usually easier to sell licenses for developments already adopted by our industry. At the same time one should also take into account the circumstance that the cell of a license seems to create additional and at the same time very convincing advertising for our developments inside the country.

Corresponding Member of the Academy of Sciences of the Latvian SSR A. F. Blyuger noted with satisfaction in his speech the ever increasing fraction of research of the Academy of Sciences of the Latvian SSR at the junction with problems with medical profile.

The majority of advances in health, success in development of diagnostic methods and treatment and prevention of diseases depend on the progress of medical science and on the rates of introduction of its results into practice, but medical science itself and its advances are determined to a significant degree by the extent to which it rests on fundamental natural scientific

research. Therefore, the role of the Academy of Sciences increases from year to year in development of medical science and improvement of health.

The decree adopted in September 1977 by the Central Committee of the CPSU and the Council of Ministers of the USSR on measures for further improvement of national health emphasizes the role of the Academy of Sciences in the development of medicine.

The Academy of Sciences of the Latvian SSR has long manifested great interest in problems of medicine, but whereas medical problems were previously reflected in the plans of the institutes of the division of chemical and biological sciences, now the institutes of the physics and engineering division and even the division of social sciences have been included in this research.

The Institute of Economics jointly with the Riga Medical Institute is conducting important work on forecasting the demographic situation since the problem of the labor resources and many other problems of the national economy are closely related to this.

Research traditional to the academy is now being carried out on the problem of "Search for and study of new medicinal preparations" at the Institute of Organic Synthesis and the Institute of the Chemistry of Wood has been included in this problem. A new class of compounds based on natural polymers (tselnovokain and tselnovokarpin), which reduced to a significant degree the toxicity of the initial raw material, increased its activity and length of action and expanded the sphere of application, has been introduced into practice by medical workers jointly with this institute. The first domestic adsorbent of bile acids which was at the same time an extremely promising preparation and treatment of atherosclerosis, was created with the participation of this institute.

The extensive program of joint work by the Kidney Transplant Center and Institute of Biology was noted in the field of study of a preparation which corrects calcium metabolism.

The Institute of Inorganic Chemistry has brought the anticorrosion preparation antikor-2 to industrial production. Tests of the preparation at the Institute of Traumatology and Orthopedics indicated that its use in sterilization of instruments extends the life of the set of instruments three-four times. It may be used in sterilization of fasteners in bone fractures.

The 25th CPSU Congress distinguished cardiology, oncology and viral infections as the main trends in development of medical science. The institutes of the Academy of Sciences of the Latvian SSR are conducting their own research related to medicine in these very directions.

We may note with satisfaction that the Institute of Organic Synthesis has completed a check and has introduced two new preparations into medical practice during the past few years for treatment of the most widespread heart

diseases: stenocardia and hypertension. The Institute of the Mechanics of Polymers is developing the problem of the biomechanical properties of the walls of the vessels. Based on research of the Institute of Physics, the Institute of Traumatology and Orthopedics is adopting a method of treating aneurysms of the deep vessels of the brain and thromboses of the vessels by using oriented magnetic fields without surgical interference.

The institutes of the academy have accomplished a great deal in the field of oncology.

The "Tasi-2-Rastr" automated system for oncoprophylactic examination of the population, developed by the Institute of Electronics and Computer Technology, makes it possible to examine hundreds of patients per day. It increases sixfold the capability of early identification of malignant tumors of specific localizations. If we are talking about oncology, it is impossible not to mention the widely known preparation of the Institute of Organic Synthesis -- fluorofur.

A specific task was posed to medicine at the 25th CPSU Congress -- find effective methods of prevention and treatment of flu. During the past 3-4 years, the Institute of Organic Synthesis and the Institute of Microbiology imeni Avgust Kirkhenshteyn have introduced a preparation for prevention and chemotherapy of flu -- remantadine, which is produced at the "Olaynfarm" Enterprise, for practical use in health practice.

However, it is feasible to raise the question of the rates of introduction of developments of the Academy of Sciences with regard to introduction of remantadine into practice. Twenty years were expended on introduction of furazolidone for treatment of intestinal infections, while production of remantadine was organized within 5 years. This is also good and bad: good that it is four times more rapidly and bad that 5 years were still expended on organization of production of a very necessary preparation.

Viral hepatitis should be mentioned among the viral infections which are an object of serious scientific research of the scientists of the republic. It is gratifying to note that the medical institutions of the Latvian SSR jointly with the Institute of Microbiology imeni Avgust Kirkhenshteyn are conducting research on an extensive program which provides in the final analysis development of a vaccine against serum hepatitis.

A. F. Blyuger completed his speech with an analysis of unutilized reserves. The main thing that cooperation with the Academy of Sciences may provide to medical workers, said A. F. Blyuger, is to develop new directions of research at the junctions of the sciences such as the directions of magnetobiology and biomechanics mentioned above. They open real prospects for qualitatively new solutions to specific medical problems.

The deputy director of the Institute of History, Corresponding Member of the Academy of Sciences of the Latvian SSR A. K. Biron emphasized in his speech that all the activity of the institute was directed toward fulfilling the

tasks of the five-year plan ahead of schedule at a high theoretical level. Taking into account the decisions of the 25th CPSU Congress, our historians devoted main attention to development of fundamental problems organically related to modern life.

Among the most significant achievements of the institute during the reporting year may be included preparation of a number of sections of the major work on the history of the Baltic peoples, carried out together with the Institute of History of the USSR Academy of Sciences and with the institutes of history of the academies of sciences of the Estonian and Latvian SSR. The first volume of a historical-ethnographic atlas was prepared in 1977 under the supervision of the Institute of Ethnography imeni N. N. Miklukho-Maklay of the USSR Academy of Sciences, work on the history of the city of Riga was completed and books on the history of the Great October Socialist Revolution, the history of social thought in Latvia and archaeology were published.

The works prepared by colleagues of the Institute of History, emphasized A. K. Biron, serve the cause of communist education of the Soviet people and contribute to strengthening of friendship between the peoples of our country. The works of the institute play a specific role in the struggle with view hostile to Marxism and they are directed against the inventions of bourgeoisie immigration and against the antiscientific versions of the West German "Ostforschung."

During the reporting year, the Institute of History jointly with scientists of the Latvian State University imeni P. Stuchki and the Institute of History of the Party Attached to the Central Committee of the Communist Party of Latvia prepared and held scientific-theoretical conferences devoted to the 60th anniversary of the October Revolution. This year the workers of the institute have actively begun preparation of scientific measures devoted to a significant date in the history of the Latvian people -- the 60th anniversary of formation of the Soviet Socialist Republic of Latvia in 1919. A. K. Biron emphasized that these landmarks on the path toward formation of the revolutionary power of the working people as publication of the manifesto of the Temporary Government of Soviet Latvia, dated 17 December 1918, recognition of the independence of Soviet Latvia by the government of Soviet Russia, the victory of the armed uprising of Riga workers on 3 January 1919, convening of the First United Congress of Soviets of Latvia and carrying out a number of socialist transformations must be widely exposed in the periodic press.

A. K. Biron noted that new research on the history of the revolutionary movement in Latvia and on the history of World War II and the history of the cities of the republic can be accomplished on the basis of the factual material accumulated during the past few years. The need to expand research in the field of source science is being felt ever more acutely with each year. The need for clearer determination of the position of subject matter in the history of science and technology in the creative plans of the professional historians of the republic is felt ever more persistently during the era of the scientific and technical revolution.

A. K. Biron especially shared his thoughts in his speech of how much more should and may be done to improve the quality and effectiveness of scientific research by thorough study of methodological and historiographic problems, well thought-out coordination of research, timely discussion of the prospects of individual and collective research, clear substantiation of the timeliness and need for prepared works and determination of their nature and format. The requirements on manuscripts intended for publication, both in content and in language and formulation, should also be increased.

Previous experience shows that the collective of the Institute of History has achieved the correct combination of various types of scientific production which successfully complement each other and which contribute to further development of the historical thought in the republic.

We feel, stated A. K. Biron, that monographic investigations as the sum of many years research at a high professional level will now become one of the main types of scientific work when the overall pattern of the historical process in Latvia has been recreated and when systematic courses in the history of the republic and which generalize the work on a number of important of historical problems have been written and when topical collections of articles and valuable document publications have been published.

The collective of historians of the academy are faced with important and responsible tasks and this requires attention to certain problems of an organizational nature. At one time, at the initiative of Academician A. A. Drizul, a department of history of Soviet society was created. The time has now come to separate an independent department from it on the study of the history of developed socialism.

The historical process, closely related to current problems, should be illuminated in the given field of research. This places special responsibility on researchers and optimum conditions should be created for their successful work.

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